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ABSTRACT

These five issues of a magazine designed for highly gifted and talented secondary students address marine science, anthropology and archaeology, making the most of summer, medicine and health sciences, and the World Wide Web. Featured articles include: (1) "The Ocean's Call: How My Love for the Ocean Grew into a Career" (Jessica Schulman Farrar); (2) "Summer Programs in Marine Science: Fun and Learning by the Sea" (Lauren Toth and others); (3) "That Sounds Like a Fish Story: Volunteering at the Ocean Discovery Center" (Maria Saltzman); (4) "More Than Just Water: The National Ocean Sciences Bowl" (Amanda Bowling and Laura Orem); (5) "All the World's a Stage: My Life as a Thespian" (Laura J. Khalil); (6) "Anthropology: Putting Everything in Context" (Laura Zimmer-Tamakoshi); (7) "My Passport in Time" (Alexander Soloman); (8) "Ghana's Kingdoms of Gold" (Jamie Lynn Maglietta); (9) "More Than Artifacts: What I Discovered at the Center for American Archeology" (Luke Brandy); (10) "The Piltdown Man Hoax" (Laura Orem); (11) "Among My Peers: Four Summers of Academic Programs" (Cassandra Wolos); (12) "Selected Academic Summer Programs 2001"; (13) "The Summer Job That Turned into a Career" (Megan Chapell); (14) "Scripting the Perfect Summer: How To Spend Your Summer Doing the Things You Enjoy" (Jeremy Stoller); (15) "A Doctor without Borders" (Melissa Hartman); (16) "Improving Patients' Lives One Small Gesture at a Time" (Yi Zhou); (17) "Nursing: The Unexpectedly Perfect Career for Me" (Bronwen Dean); (18) "Better Medicine: Trends in Health Science" (Carol Blackburn); (19) "Microarrays: Dawn of a New Era" (Matthew Kidd); (20) "Lessons from the Lab: A Mentorship in Pharmacology" (Kevin Yang); (21) "Getting the Most Bang for Your Click: Efficient Web Research" (Melissa Hartmann)"; (22) "BeachNet: A Computer Nerd's Dream" (Glenn Willen); (23) "A Better Mousetrap: Building Northern Light Web Search Engine" (Joyce Ward); (24) "Making Sites That Work" (Nolan Glantz); and (25)

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"Jekyll and Hyde: How the Internet Brings out Our Best and Our Worst" (Melissa Hartmann). (CR)

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Imagine...Opportunities and Resources for Academically Talented Youth, 2000-2001.

Melissa E. Hartman, Editor

Volume 8, Numbers 1-5
Sep - Oct 2000 - May-Jun 2001

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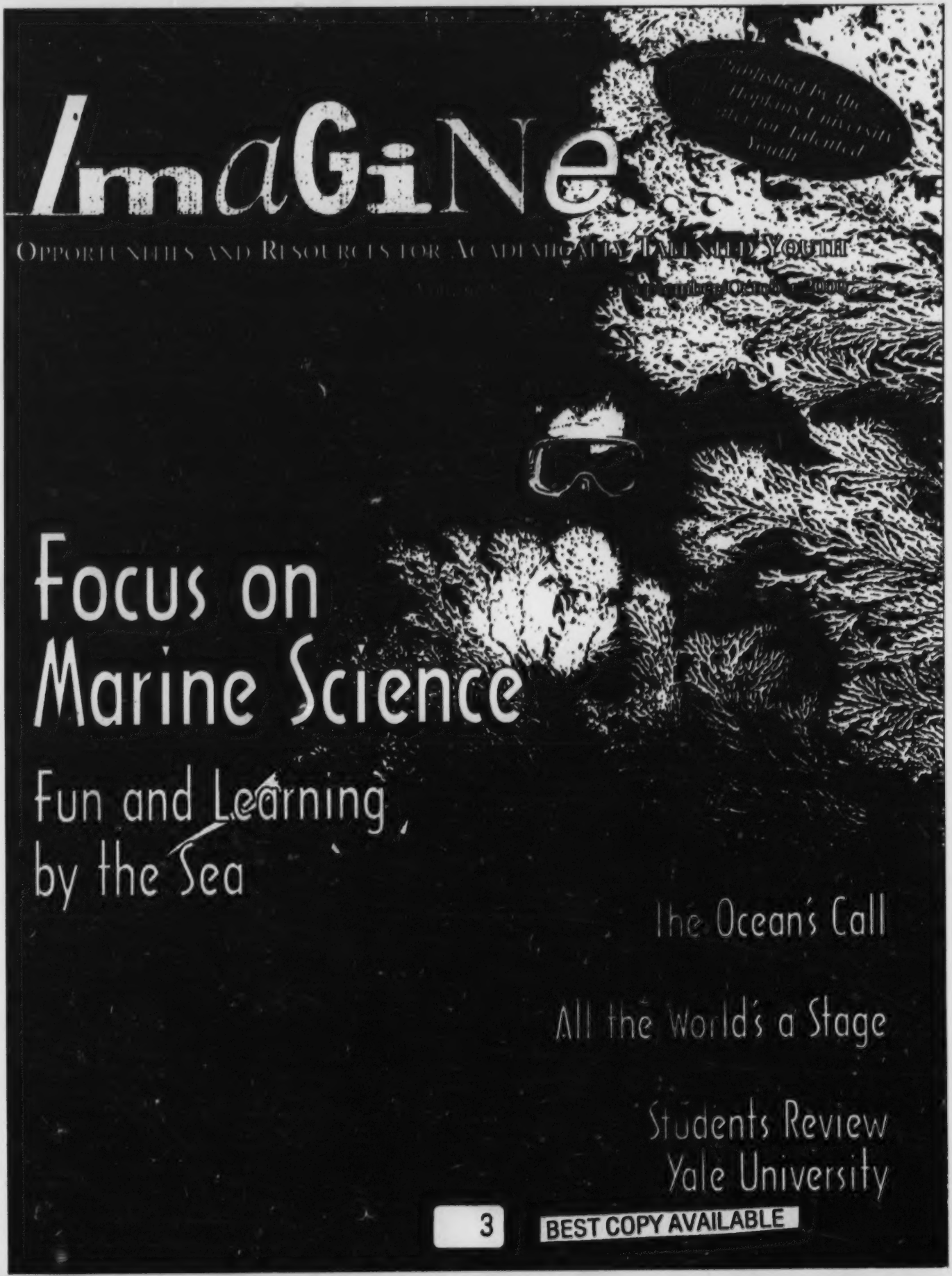

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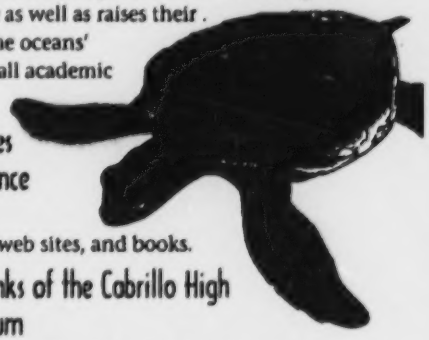

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*Opportunities and Resources for Academically Talented Youth**

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Editor • Melissa E. Hartman
Assistant Editor • Laura Orem
Contributing Editor • Diane Clavier
SET Director • Linda E. Brody, Ed.D.
Research Associate • Carol C. Blackburn, Ph.D.
Editorial Assistant • Vicki Moore
Designer • Delta Graphics & Communications

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Address subscription inquiries to:
Imagine
P.O. Box 3073
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(215) 826-0707 • fax: (215) 788-6887

Address editorial correspondence to:
Melissa E. Hartman
SET/CTY
The Johns Hopkins University
3400 North Charles Street
Baltimore, Maryland 21218
(410) 516-0309 • fax: (410) 516-0108
email: mhartman@jhu.edu

Web site: www.jhu.edu/gifted/imagine

Welcome!

Welcome to a new volume year of *Imagine*! We've come a long way in eight years, but our mission hasn't changed: to bring you the kind of information you need as a highly gifted and talented student to make the most of your precollege years.

In this issue, you'll find lots of great information about our focus topic, Marine Science, as well as our regular columns and other interesting and informative articles. Upcoming this volume year, we'll also be covering Anthropology and Archaeology, Summer Activities, Medicine and Health Sciences, and the Web. Remember, *Imagine* is largely student-written, so we want to hear from you! Contact Melissa Hartman at *mhartman@jhu.edu* or (410) 516-0310 if you are interested in writing an article for *Imagine*.

We are also introducing a new editorial feature: the Readers Panel. The Readers Panel is made up of student readers who will provide feedback to the editorial staff on each issue and ideas for topics to cover. The Readers Panel for the 2000-2001 volume year will be:

***Kathleen Brennan**, 17, Morris Plains, NJ, is a senior at Villa Walsh Academy, where she writes for the school paper and is the president of her chapter of Students for a Free Tibet. She is interested in political science and international relations and is active in the Junior State of America and Amnesty International.*

***Rachel Culley**, 15, Mercer, ME, was homeschooled until the age of 12. She loves to write, especially poetry, and hopes to major in English in college. She also enjoys photography, cross country and track, lacrosse, theater, choir, horseback riding, and reading.*

***Qi Feng**, 15, West Roxbury, MA, attends Boston Latin School, where he is co-captain of the math team. He also plays doubles for the varsity tennis team and second violin for the string ensemble. He volunteers at the American Red Cross of Massachusetts Bay, and enjoys reading the classics and mystery/suspense novels.(See Qi's article, "Protecting a Reservoir, Beautifying a Beach," in the Sept/Oct 1998 issue of Imagine.)*

***Jeremy Stoller**, 15, Albany, NY, is a tenth grader who enjoys writing, acting, art, and tap dancing. He also plays the piano, participates in Tae Kwon Do, and hopes to become a writer.*

***Marcella Veneziale**, 13, Garden City, NY, attends Garden City Middle School, where she is in the Challenge program for English and Social Studies, as well as honors math and an integrated honors class. She has been a Girl Scout for four years and enjoys tennis, soccer, reading the classics, and writing creative stories. She also plays the flute in a jazz band and in her school's select band.*

***Tanya Wolters**, 13, Carlsbad, CA, attends La Costa Canyon High School. She is an avid reader and also enjoys writing poetry (see her poem "Words" in the Jan/Feb 2000 issue of Imagine), competitive cheerleading, classical piano, and spending time outside.*

***Shengping (Shelby) Yu**, 15, Columbia, MD, attends River Hill High School, where she was named the second place winner in Maryland for the Letters About Literature Level II Contest. She also founded and coordinated the Howard County Student Conferences, which focused on expanding the horizons of high school students and featured speakers on conflict resolution and other important issues.*

Corrections & Changes

The URL for the Anthropologist in the Field was printed incorrectly in our last issue. The correct address is www.truman.edu/academics/ss/faculty/tamakoshil/index.html

Visit our Web site at www.jhu.edu/gifted/imagine

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The Ocean's Call

How My Love of the Sea Grew into a Career

by Jessica Schulman Farrar

Left to right: Jessica (right) at seven, already at home on the water; powerboating while in graduate school at VIMS; today, sailing on the Chesapeake.

I love telling people what I do. Whenever I introduce myself as a marine biologist, people get very excited. "Do you work with dolphins?" they invariably ask. No, I laugh. I'm one of the 99.9% of marine biologists who do not work with dolphins.

I can't remember when I first knew I wanted to be a marine biologist. The idea was just always there. Maybe it was the summers at Cape May and Cape Cod with my family. I remember spending hours mesmerized by little crabs scurrying along the sand, and sifting through the mysterious things that would wash up during the night: seaweed, shells, and critters from somewhere far beneath the ocean surface.

My first real field experience in marine biology came when I was 12. That summer, I took Marine Ecology at CTY, and it was wonderful. I learned everything from plate tectonics to the anatomy of a horseshoe crab and a spiny dogfish. My favorite days were the field trips. We went seining for fish in the Susquehanna and had a backstage look at the National Aquarium in Baltimore where we got to walk on the access planks above the shark tank. I was hooked.

In college, at Stanford University, I majored in Earth Systems, an interdisciplinary major that includes biology, geology, civil engineering, economics, and public policy. I spent a wonderful quarter living and working at Stanford's Marine Station in Monterey, conducting research on habitat use patterns of a deep-sea cat shark. There I joined researchers from the nearby Monterey Bay Aquarium who used an unmanned, remotely-operated vehicle to study the depths of the Monterey submarine canyon. It was amazing to watch vivid, color images of creatures lurking some thousand meters below as we bobbed on the surface of the bay.

When you study the marine world, it's impossible not to be aware of how much impact humans have on marine species and habitats. My courses, in topics from conservation biology to environmental policy, all deepened my awareness of the many ways we are affected by and affect the natural environment. I also found that our laws and customs concerning use of the environment must strike a precarious balance: they must protect our planet's limited resources while also enabling humans to create an existence from the land and the sea. Everything we do in every culture around the world is intertwined with our environment. Some activities, like farming, fishing, and mining, provide us with very direct benefits from the local environment, while others, such as shipping goods across the oceans or generating power from our waterways, utilize our environment in more complex ways. The more I learned, the more I became interested in our complex relationships with the sea, and in the ways people use—and sometimes abuse—the marine world.

My understanding of these issues deepened while I was a graduate student at the Virginia Institute of Marine Science. There I studied a different ecosystem and one of its primary residents: the blue crab of the Chesapeake Bay. My work was funded by a governmental agency responsible for maintaining a healthy crab population. Crabs are an important source of income to fishermen and restaurants throughout the region, and crab feasts are a time-honored summer tradition in the area, so the health of the blue crab population is important to many people for many reasons. Because of this link between environmental and economic concerns, I got to report my findings at both scientific conferences and fisheries management hearings. It was this balance between theoretical and applied marine science that truly enticed me. By the time I graduated, I knew that I wanted to work in the complex and sometimes contentious realm where economic interests intersect with environmental ones.

A Sea of Opportunities

When I finished graduate school, I had many options. The sheer range of possibilities open to me is one of the things I love about marine sciences; there are so many ways to be involved. Some of my classmates went on to academic facilities, such as colleges or marine research institutes. Others chose to work in government agencies like the one I reported to when I was a grad student. Still others found homes at environmental advocacy organizations like the Nature Conservancy and World Wildlife Fund. I took yet another tack, and became an ecological risk assessor at an environmental consulting firm.

Consultants often work directly or indirectly for state and federal governments. The government hires marine biologists to answer questions about how to protect aquatic resources from the impact of our activities, and how to restore them if they are damaged. In my work, these are the kinds of questions I deal with every day. Sometimes the government hires me to conduct a study. Other times, a company hires me (usually in response to a government regulation) to investigate the ecological health of one of their sites or to assess the ecological consequences of an activity they perform. I've studied the impact of dredging navigational channels on aquatic communities, and worked with power plants to figure out how they can avoid killing aquatic life in their intake pipes. I've helped clean up contaminated places around the United States, from old Army bases to industrial sites, so that they won't pose harm to nearby aquatic resources.

As a consultant, I no longer seine for fish or watch sea-canyon creatures on a video monitor. Now I use my knowledge of marine science to help others make ecologically sound decisions. My clients hire me to provide them with guidance on topics they don't know enough about. When I assess a site, looking at it from an ecological perspective, I am bringing a kind of knowledge to the decision-making process that no one else on the project has. I become the voice for the site's ecological resources and residents. I have a huge sense of pride and accomplishment in my work, because I know that my involvement with a project or a site can have a direct and beneficial impact on the environment.

Being a consultant is constantly refreshing and exciting. Every time I start a new project, I know I'll learn something new. Sometimes I learn about a new habitat or species, sometimes about toxicology or chemistry or engineering. I love the diversity of opportunities that my work offers me, and love knowing that I will always keep learning about the marine world. And I love being able to get out on the water and call it work.

Sitting on a boat, hearing the lapping of waves on the hull, feeling the warm, summer breeze that smells of salt and life in a world below the surface, I smile to myself. I am so lucky. The line between my work and my life is very blurred. Out here, on this boat, is it the weekend or the work week? Does it really matter? I am just happy to be here, in the midst of this world I love so well.

Jessica Schulman Farrar now lives near the Chesapeake Bay and spends her work and free time thinking about the water and the outdoors. She is an avid sailor and power-boater and enjoys fishing and hiking with her husband and yellow Lab.

The World of Marine Science

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Summer Programs in Marine Science

FUN AND LEARNING BY THE SEA

When you wake up in the morning, the first thing you hear is the pounding of waves on the beach. You jump out of bed, eager to start the day, but instead of your most stylish Speedo and sunglasses, you throw on an old pair of jeans and a worn sweatshirt, grab your net and collecting jar, and hit the shoreline. You're not on vacation—you're at an academic summer program to learn about the oceans and the lifeforms that inhabit them.

There are many summer programs for middle- and high-school students that focus on marine science. We are highlighting a few here, as told by students who have actually participated in them. Some programs are more academically stringent than others, but all offer the opportunity for hands-on experience with marine organisms and the ocean environment.

If you are interested in any aspect of marine science, you might want to investigate some of these programs further. Don't forget to check out the list of additional programs that follows. While sometimes the living conditions are a bit Spartan (remember, these aren't Club Med getaways), the benefits of spending part of your summer immersed in the study of the oceans can extend into your college years and beyond.

Seacamp: The Ocean Is My Classroom

by Lauren Toth

Located on a small peninsula in the heart of the Florida Keys, Seacamp offers a unique and beautiful setting to participants. The summer camp for 12- to 17-year-olds focuses on a combination of academic, recreational, and safety skills, including marine investigations, independent research projects, scuba diving, photography, and lifesaving. Each session is 16 days long.

A five-year veteran of Seacamp, Lauren Toth finds the location and the hands-on learning methods irresistible.

Looking out at the ocean from the far end of camp is like looking at a postcard: crystal clear water sparkling in the warm Florida sun, and tiny islands dotting a horizon that fades into the cool azure sky. What could be more tranquil? But the fantastic view is just one thing that makes Seacamp the perfect place to learn and play for two-and-a-half weeks of summer.

A Beautiful Day in the Neighborhood

Not only is Seacamp's setting beautiful, it's also close to a variety of ocean habitats that are as unique as they are fascinating. I love watching the tiny juvenile fish darting around the mangrove root communities. Compared to them, the crabs and snails seem to be stuck in slow motion. In the sea grass beds, I sometimes catch a glimpse of a playful seahorse or maybe a graceful stingray. One of my favorite places is a place called Octopus's Garden, a sea grass bed where octopus and squid sightings are common.

The Florida Keys harbor some of the world's most rare and fascinating marine communities: coral reefs. Classes often go snorkeling at the nearby "Coral Heads," where it is not unusual to see a school of parrotfish, some queen

angelfish, a territorial damselfish, and maybe even a shark all in one visit. The reef at Looe Key is a long boat ride away, but well worth the trip. The colors of the coral range from deep purple to vivid oranges and yellows. A protected marine sanctuary, the reef is teeming with life. Schools of silversides often form an impenetrable wall under the water. Moray eels swim confidently from rock to rock. It's a great place to see sharks, and on a good day, maybe even a dolphin.

Being There

The variety of marine communities makes Seacamp a great place to study topics such as marine invertebrates, animal behavior, coral reef ecology, marine symbiosis, and marine adaptations—to name a few courses offered to campers. The best thing about the classes is that instead of sitting in a classroom, you learn by going out into the communities and snorkeling in them. There you can make first-hand observations of whatever you're studying.

Seacamp also teaches skills that make venturing out into the deep safer and more fun. Over the years, I've learned to windsurf and drive a boat. I've become a certified lifeguard and a NAUI certified "Master Diver." I'll never forget the feeling I had on my first SCUBA dive; as I drew my first breaths down in the depths, I felt as if I had become a part the underwater world.

Seacamp is a very special place, and I look forward to my time there each year. At the end of each session, I take something new home with me: new skills, new knowledge, new memories, and a deepening respect for the oceans and the lives inside.

For information, contact Seacamp, 1300 Big Pine Avenue, Big Pine Key, FL 33043-3336; (305) 872-2331; infor@seacamp.org; www.seacamp.org

Lauren Toth is a 16-year-old junior at Alexander W. Dreyfoos, Jr. School of the Arts, where she is a communications major. She enjoys SCUBA diving and other water activities, and hopes someday to become a scientist, possibly a marine biologist.

Woods Hole SEA Programs: Fantastic Voyage

by Vanessa Michelou

The Woods Hole Sea Education Association offers two summer courses for high school students: Science at SEA, a 20-day course for students who have completed grade 9, 10, or 11; and Oceanography of the Gulf of Maine, a 17-day course for students who have completed grade 10, 11, or 12. Both are rigorous academic programs that include written assignments, tests, and presentations. Students in the Oceanography course earn four undergraduate credits from Cornell University.

During the summer of 1999, Vanessa Michelou participated in the Oceanography of the Gulf of Maine course, which included an eight-day shore component on Appledore Island in the Isles of Shoals, Maine, and a ten-day oceanographic voyage on the Gulf of Maine, George's Bank, and the waters around Cape Cod.

Appledore Island was cold and bare. The sound of a million seagulls made it almost impossible to sleep, and the fierce mosquitoes attacked without mercy. During the first couple of days, we walked the shores of Appledore under the burning sun. But as participants in the Woods Hole SEA Programs, we pushed these discomforts aside in our quest for knowledge. Copepods, starfish, algae, and even crustaceans filled our collection buckets. Lectures took up half of the day, and the other half was spent searching, dissecting, analyzing, identifying, and memorizing the names of over 1,000 species. By the end of the week, our tired and smelly group—showering was limited and salt water isn't entirely cleansing—knew more about the species of Appledore than most of its human inhabitants do.

Out to Sea

Armed with our newly acquired knowledge, we were ready to head out to the open sea for a voyage of discovery. When we climbed aboard the schooner SSV Westward, thoughts of playing with dolphins, feeding colorful fish, SCUBA diving for long hours, and sunning on the deck filled my mind. But what awaited us was something I had never expected.

After learning to fit my 5'10" frame into the tiny cocoon-shaped bunk, I soon discovered that the ship never stopped rocking. Seasickness (and moving furniture) was a whole new experience. So was daily life aboard a schooner. It had never crossed my mind that I would be scrubbing the galley at midnight, watching the helm until 3:00 a.m., or spending an afternoon cleaning toilets and polishing brass.

Although some of our tasks were less than thrilling, we ultimately got more from our duties than we gave. The 24 students on board were divided into three watches of eight people. I found in my seven partners a second family.

Together, we steered the ship, monitored the lines, and marveled as the sun slowly replaced the mantle of stars in the sky.

Every day or two, we operated the ootertroll, a contraption that collects sediment samples from the bottom of the sea by means of a bucket on a metal chain. I also spent long hours during lab watch "twinkling": collecting water during different parts of the trip and measuring the components of the water—salinity, phosphates, and amount and kind of plankton. We put the water into a beaker and added chemicals to measure the concentration of various components. When the week was over, I understood how the ocean floor had formed and could track the water current. I knew about the millions of kinds of plankton and the chemical composition of the water in all corners of the gulf.

Continued on page 8

Continued from page 7

Uncovering the Magic

I never saw dolphins, and the penetrating sound of the ooter-troll was as close as I got to listening to the songs of the whales. But as I gazed at the clear sky with its million stars, I knew I had found something better. Understanding the dark mystery of the deep gave me immense satisfaction. Even the biting cold seemed to decrease as I worked with the whole crew to set the main sail or watched the sparkling and endless waters from the top of the mast.

Underneath the surface of the ocean is another world that many humans never see. I want to learn its secrets. Every creature, every current, is there for a reason. Every mystery can be explained. At the end of my two weeks at SEA, I knew that I had found my calling.

For more information, contact Woods Hole SEA Programs, P.O. Box 6, Woods Hole, MA 02543; (800) 552-3633; www.sea.edu

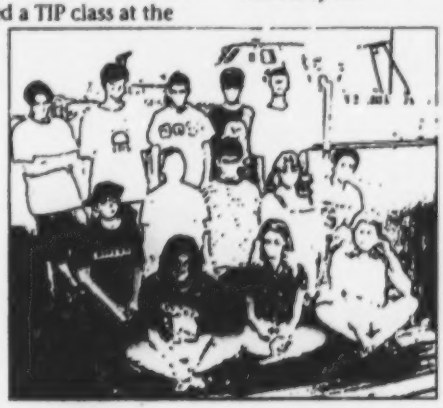
***Vanessa Michelou** was born in Arlington, VA, but grew up in Bogota, Colombia. In June, she graduated from an American private school and is currently a student at the University of South Carolina at Columbia, where she is majoring in marine science.*

TIP Marine Lab: Life at the Ocean's Edge

by Jerry Liu

In the summer of 1999, Jerry spent a session at the Duke University TIP Marine Science Summer Program, a highly challenging program for students in grades 7–10 who earn qualifying scores on either the SAT or the ACT. The courses at TIP include Behavioral Ecology, Coastal Ecology, Physiological Ecology, Invertebrate Zoology, and The Biology of the Ocean.

Imagine spending part of your summer at the beach while learning all about marine science and ecology. That's what I did for three weeks last year, when I attended a TIP class at the Duke Marine Lab in Beaufort, North Carolina. Not only did I have a lot of fun, make friends, and spend an exciting time away from home, but I also learned many things about the ocean and the varied and fascinating lifeforms that live in it.



Denizens of the Deep

During my time at the Marine Lab, I chose to study physiological ecology, a branch of marine science that focuses on how marine animals adapt to and live in their environments. A friend of mine had taken this course, which is taught by Dr. Bruce Kenney and his assistant, Jason Hurst, and highly recommended it to me.

The course consisted of lectures and field work. One of the advantages of taking TIP classes at the Marine Lab is that students live right next to the ocean. Dr. Kenney and Mr. Hurst would take us out onto the beach to collect animals to study. We would either collect them from the ocean with nets (for creatures like starfish, sea squirts, blue crabs, sea urchins, finfish, and comb jellies) or dig them out of the sand (for clams, mussels, sea cucumbers, and hermit crabs). We would then take our catch back to the classroom where we had tanks set up, in order to discover how each lived in its habitat, what kind of food each ate, and what kind of environment each needed to survive. The marine life also provided entertainment in case the lectures got a little dry!

That didn't happen often, though. There was always something new to learn about the animals we captured. For example, Dr. Kenney explained that if you cut a starfish into two symmetrical parts, it will grow into two separate starfish. Another fascinating creature was the sea squirt. These small, odd, tubular animals attach to rocks or shells, taking in water and filtering out microscopic organisms to eat; if you squeeze them, water will shoot out of their pores, much like tiny water guns. It was great to learn how marine animals like these actually fit into their environments and understand why they did what they did.

Fun in the Sun

But TIP wasn't all classes and labs. Part of the fun were the activities planned for each evening: bowling, movies, sports, games, or just hanging out with friends and talking. These activities helped the students get to know each other better than they could just in the classroom. We even had a friendly competition at the end of our session, including a hilarious water balloon toss and a talent show. One of the things I had to get used to was sharing a room with three other students, but it helped everybody learn to cooperate and share. A bonus was that I learned to do my own laundry and get myself out of bed in the morning.

A summer at TIP is something I would definitely repeat if I had the chance. Not only did I make friends and have a great time (even the food was good!), I had the opportunity to learn about marine organisms up close and personal, right in their own environment.

For more information, contact Duke University Talent Identification Program, Box 90747, Durham, NC 27708-0747; phone (919) 684-3847; fax (919) 681-7921; info@tip.duke.edu; www.tip.duke.edu

***Jerry Liu** is 16 years old and lives in North Carolina, where he attends Leesville Road High School. He enjoys computer programming and basketball, and in his free time likes to play sports with his friends and surf the Web.*

CAA Marine Physics and Engineering: Get on the Boat

by Chris Kavulich

The Center for Talented Youth offers popular summer courses such as The Blue Crab, The Chesapeake Bay Oyster, and Whales and Estuary Systems through its CAA program. Applicants must earn qualifying scores on the SAT-I to be considered for these three-week courses.

During the summers of 1998 and 1999, Chris Kavulich participated in CAA's Baltimore program. His most recent class was Marine Physics and Engineering.

When you think about "marine science," the first thing that comes to mind may be "marine biology." That was what I thought when I opened up my freshly printed CAA Summer Course Selection catalogue last year. I had taken the Whales and Estuary Systems course the previous year; the other classes seemed interesting, but not quite right for me. Then I turned to the last page of marine sciences courses and came across a new class, something I'd never considered before: Marine Physics and Engineering.

That sounds really intriguing, I thought. I enjoy engineering, and I was going to take Honors Physics in the fall, so perhaps this class would be a good idea. But what I got from the class went far beyond what I could have predicted.

Ship(s) Ahoy!

The first week was intense. On the first day of class, my heart started sinking as we put together a notebook of what seemed like a million pages (at least 300) that was to be our combination workbook and textbook. Despite the initial panic, these classes were great. We began by studying the forces that move a boat and keep it above water, focusing on topics like buoyancy, stability, displacement, and other tensive, compressive, and sheer forces. Through a series of lectures, experiments, and discussions, we crammed more information into our heads than I thought possible in a week.

When not in class, we toured the ships in the Baltimore Harbor flotilla, including the *U.S.S. Torsk, Chesapeake,* and *Constellation.* My favorite, the *Constellation,* is a 19th-century naval frigate. It had just been refurbished, and we were the first civilian non-workers allowed below the tourist areas.

We spent most of our second week in one of America's most famous maritime cities: Annapolis. We visited the U.S. Hospital Ship *Mercy,* strolled through the Naval Academy, stopped at a Coast Guard Station, dropped in at a sailmaking shop, and toured the Maritime Museum. We also took an overnight boat trip on the tall ship *Imagine* to St. Michael's, a historic town on Maryland's Eastern Shore. All this time spent on boats and ships gave us a chance to see how the principles of the first week are applied to the construction and workings of seagoing vessels.

This Rocket Floats

I enjoyed all of the sightseeing, but what made the class most memorable for me was the ship-building project. We had to construct a model cargo ship of given specifications, using aluminum, styrofoam, and cardboard. While most people worked on their ships alone, I teamed up with a partner. Using a computer-aided drafting program, we developed *The Rocket,* a streamlined catamaran complete with outriggers. What made the creation of our ship so meaningful was that we finally understood the concepts we had discussed at the beginning of the course. In fact, I even called on some of my experiences the previous year in the Whales and Estuary Systems course!

Our biggest challenge was getting our boat to float. After constructing the keel and ribs, we added the outer skin and extra internal supports to hold the cargo. It was quite a disappointment when we realized that, despite all our hard work to make the ship airtight, the hot glue holding it together simply dissolved in the water. Finally, we hit upon adding layers of plastic wrap to the outer skin and using water ballast instead of stone ballast. It worked!

The final product of all this work is now on display in my room. It is the happy result of taking the knowledge I gained in both my current and earlier CAA classes and applying it to a specific project. By taking "the road less traveled"—Marine Physics and Engineering—I learned how to turn concepts into reality.

For more information, contact Center for Talented Youth, CAA Summer Programs, Johns Hopkins University, 3400 N. Charles Street, Baltimore, MD 21218; (410) 516-0278; ctyinfo@jhu.edu; www.jhu.edu/gifted/programs.html

Chris Kavulich is 17 years old and attends Carlisle High School in Carlisle, PA. He enjoys engineering, American history, and computers, and is a three-sport athlete. While becoming an engineer is definitely in his future, he still enjoys the simplicity of constructing things from Legos.

Oceanography: Unexpected Lesson on Mount Desert

by Alexis Burakoff

Located in Seal Harbor, Maine, Acadia Institute of Oceanography offers two- week sessions for students ages 12–18. The Basic Sessions introduce students ages 12–15 to basic marine concepts and laboratory procedures; the Advanced Sessions provide additional challenge for students ages 15–18 who have completed high school biology or chemistry.

In the summer of 1998, Alexis Burakoff participated in the summer program for marine studies on Mount Desert Island. She chose the advanced session, which is open to students who have completed a basic high school biology course. This involves a combination of lectures, field trips, and laboratory hours interspersed with both scheduled and unscheduled recreational time. Labs range from classification exercizes to hands-on experiments. Her first overnight camp experience, the two weeks were full of surprises.

My first emotion upon arriving at Acadia Institute of Oceanography (AIO) was disappointment. On my way to Seal Harbor, I pictured an impressive campus in the middle of Acadia National Park: rustic cottages in the woods or airy bungalows on the beach. But the building was behind an abandoned oil vat, with a backyard smaller than a soccer field boasting nothing more than wilted grass and decaying picnic tables. I tried to have a positive attitude, but I had already begun to question the sanity of my friend Lisa, who had raved about her experience at AIO. But it turned out that she was absolutely right. My time at AIO was the most enjoyable and rewarding two weeks of the entire summer!

I wanted to make the most of the experience, so I made an effort to go to most of the optional labs, even the one at 7:15 in the morning. I discovered that, apart from their educational value, the labs were a great place to get to know the other kids. I began making friends and enjoying the academic and recreational activities. By the end of the first week, I was having a blast. I was also learning more than I expected.

Shark and Shamu

Although I enjoyed all of the labs, some were better than others. I'll never forget the thrill of placing a sand-dollar egg on a slide and watching it be fertilized and start to divide to create a new life. My very favorite lab was shark dissection. I had expected to be squeamish, but even as I cut into the heart, I felt only fascination. That experience opened a lot of possibilities for me. If I can enjoy shark dissection, I might even make it through medical school!

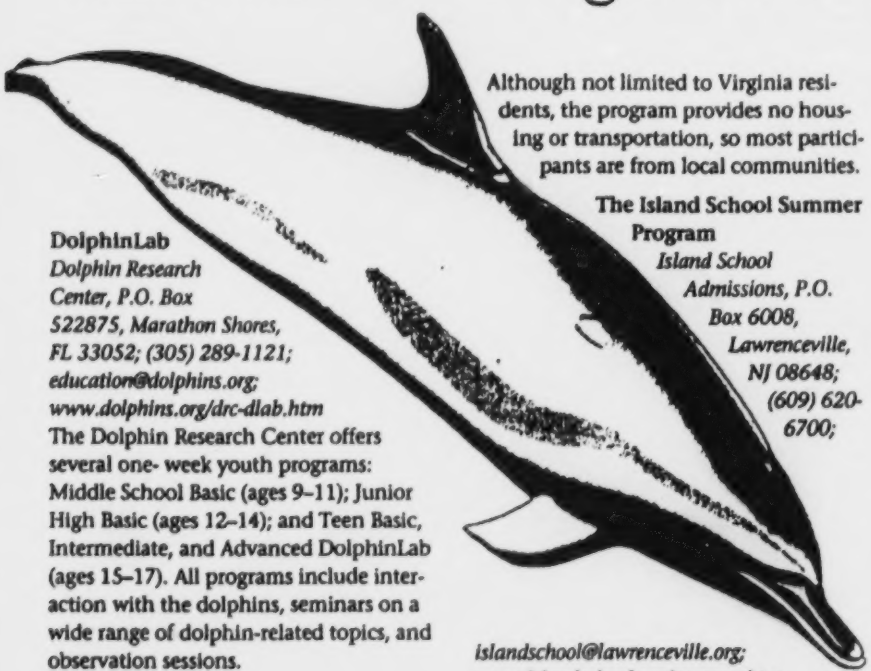
The teachers at AIO often emphasized the fact that oceanography is more than "swimming with Shamu." They lectured on topics as varied as geology and sea turtles. With each new activity, from learning basic navigation to surveying a local sound to collecting sea cucumbers and crabs for our personal tanks, the teachers would proudly proclaim that "this too could be a career in oceanography." Although that prospect didn't excite me, I still had fun learning about oceanographic phemonena from thermoclines (the temperature barrier beneath the surface of the water) to the cariolis effect (why the tides circle like they do) as well as hearing about the details of the sea horse lifecycle or the effects of the Exxon Valdez oil spill.

My time at AIO showed me that I can adapt to unexpected situations and even share a shower with 30 other people! Perhaps the most valuable lesson I learned was that I do not want to spend my life driving a boat, drawing maps of beaches, counting barnacles, testing water salinity, or even looking at plankton (although I'd go on another whale watch in a heartbeat). But even though my interest in oceanography is casual, the lab skills I developed can apply to many fields. Best of all, AIO gave me the chance to become part of a tight-knit community of faculty and students joined by intellectual curiosity and an appetite for fun.

For more information, contact Acadia Institute of Oceanography, P.O. Box 98, South Berwick, ME 03908-0098; (207) 384-4155; aio@tiac.net; www.acadiainstitute.com

Alexis Burakoff, 18, lives in Newton, MA. She attends Princeton University, where she plans to major in molecular biology, and may go on to a career in medicine. Last November she continued her AIO experience while attending the Institute's one-week trip to Jamaica (to which graduates of the advanced session are eligible to apply), which she refers to as one of the highlights of her senior year.

Other Summer Programs in Marine Science



DolphinLab
Dolphin Research Center, P.O. Box 522875, Marathon Shores, FL 33052; (305) 289-1121; education@dolphins.org; www.dolphins.org/drc-dlab.htm
The Dolphin Research Center offers several one- week youth programs: Middle School Basic (ages 9–11); Junior High Basic (ages 12–14); and Teen Basic, Intermediate, and Advanced DolphinLab (ages 15–17). All programs include interaction with the dolphins, seminars on a wide range of dolphin-related topics, and observation sessions.

Earthwatch
3 Clock Tower Place, Suite 100, Box 75, Maynard, MA 01754; (800) 776-0188; info@earthwatch.org; www.earthwatch.org
This year, Earthwatch offers 21 ocean-related expeditions ranging from Bahamian Reef Survey to Green Turtles of Malaysia. Participants age 16 and older become part of a real research project and work under the supervision of professional scientists. Expeditions range from one to three weeks and are offered throughout the year.

F.I.R.S.T. Marine Science Internship for Girls
2000 F.I.R.S.T. Program, School of Marine Science, Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA 23062; (804) 684-7134; ecanuel@vims.edu; www.vims.edu/sms/first/
For six weeks during the summer, 5–12 high school girls participate in lab and field work and complete research projects under the mentorship of female graduate students and scientists. Applicants must have completed one year each of high school biology and chemistry and two years of high school math, and must be enrolled in high school at the time of their participation. Although not limited to Virginia residents, the program provides no housing or transportation, so most participants are from local communities.

The Island School Summer Program
Island School Admissions, P.O. Box 6008, Lawrenceville, NJ 08648; (609) 620-6700; islandschool@lawrenceville.org; www.islandschool.org/summer.htm
Twenty-four high school students travel to the Bahamian island of Eleuthera for a program that combines marine science, scuba diving, and kayaking. Sophomores and juniors may also consider the Island School's 13-week semester at Cape Eleuthera.

Marine Science Consortium
7278 Enterprise Street, Wallops Island, VA 23337; (757) 824-5636; mscva@intercom.net; www.msconsortium.org
On the Virginia Eastern Shore Barrier Islands, students in grades 7–12 take one-week courses in a range of marine science topics, including Oceanography, Dolphin Behavior, Shark Biology, and several more. Courses emphasize fieldwork, giving students practical sampling and experimental experience.

Ocean Educations Ltd.
Ian Mitchell, 162 Howard Park Avenue, Suite #3, Toronto, ON Canada M6R 1V6; (416) 767-8429; ian@oceaned.com; www.oceaned.com
Students who are at least 16 years old and have completed 11th grade science courses may participate in one of two three-week sessions that take place on Vancouver Island, British Columbia. Students receive grades for labs, quizzes, an independent study project/presentation, and a final comprehensive written exam.

Oceanic Society Research Expeditions; Project Dolphin for High School Students; and Natural History Expeditions
Oceanic Society, Fort Mason Center, Building E, San Francisco, CA 94123; (800) 326-7491; www.oceanic-society.org/ose.htm
On Research Expeditions, participants age 16 and over may work side-by-side with field biologists to accomplish specific scientific objectives on 7–10 day expeditions, focusing on projects such as Surinam Sea Turtles, Peruvian Giant Otters, or any of a number of other marine biology topics.

The Oceanic Society also offers Project Dolphin, an intensive, hands-on introduction to dolphin research and marine mammal career opportunities for high school students ages 16–18. Based on the Oceanic Society's live-aboard research vessel in the Bahamas, this week-long program provides instruction in research methods as students actively collect data on spotted and bottlenose dolphins. Students also get the opportunity to snorkel and dive with the dolphins.

Younger students who are accompanied by an adult may participate in Natural History Expeditions, 5–16 day educational journeys of discovery led by a naturalist and, when possible, a local guide. Age requirements vary with the expedition; check for the trip you are interested in.

Odyssey Expeditions
650 S.E. Paradise Point Road #100, Crystal River, FL 34429; (800) 929-7749; odyssey@usa.net; www.odysseyexpeditions.org
Odyssey's three-week Field Studies voyages, which are for certified divers ages

Continued on page 23

That Sounds Like a Fish Story:

Volunteering at the Ocean Discovery Center

by Maria Saltzman

Maria Saltzman began volunteering at the UCLA Ocean Discovery Center three years ago at the age of 13. Volunteering at an aquarium can be a great way to discover if marine science is a field you want to pursue in college and beyond; it's also a terrific opportunity to gain experience working with the public. Following this article is a list of aquariums with volunteer programs; if you don't see your local aquarium represented, call them about volunteer opportunities. You can also look up aquariums in your state on the Web at www.aza.org

It's a beautiful Saturday morning, and I'm walking down a long, sloping bridge to one of the most famous tourist attractions in the country, the Santa Monica Pier. I see groups of people waiting for stores to open, street vendors to arrive, fish to bite, or just enjoying the sights and sounds of the beautiful Pacific Ocean. I walk toward the Ocean Discovery Center and, at 11:00 a.m. sharp, unlock the doors to the aquarium that is my home away from home.

If I am ever asked what makes me unique or special, the first thing that springs to mind is my work as a volunteer at the Ocean Discovery Center (ODC), an aquarium run by UCLA. For more than three years, I've helped take care of the important and valuable marine exhibits, as well as educated people about the oceans, marine biosystems, and the dangers of pollution.

I remember my first day as a volunteer. I was only 13, and I was terrified. I received a crash course in marine life and in public relations, but I was still afraid the adults would tell me what I said was wrong or that I wouldn't be able to control the first-graders under my care. But I stuck with it, and working at the ODC grew on me. As a result of my volunteer activities, I am a much happier, more mature person, and I have learned much more about the oceans than I ever imagined!

Feeding Critters

One of my jobs at the ODC is aquaristing, or caring for the animals and their tanks. As I scrub the tanks, I check on their occupants to make sure none of the animals are ill. I also feed the animals and take care of any equipment that needs cleaning. I worked at the ODC for about a year and a half before I began aquaristing; anyone who is assigned this job must take a special class, which includes a wet-lab safety component. Some of the equipment is very sharp, so it's important to know how to handle it properly.

Many people might feel squeamish at the idea of feeding sharks, jellyfish, eels, and starfish, but it's one of my favorite parts of the job.

Some of the animals, like the jellyfish, are fed brine shrimp twice a day. Others, like the sharks and eels, are fed twice a week and eat a diet of squid, shrimp, and krill. I prepare their food myself (yes, that means chopping up slimy sea creatures) and make sure everyone in the tank gets his fair share.

Sometimes that's not easy. One of our most interesting exhibits is a species of

fish called the California sheephead. These colorful fish can live to be 50 years old, but what is really remarkable about them is that, at the age of seven or eight, the most dominant females change sex to male and boss the whole tank around. Even the slope of their foreheads and coloration will change. One male in our school is so dominant we have to be extra-careful that everyone else gets to eat; he is so aggressive, he even went after the lobsters that lived in the tank, and they had to be removed.

Feeding Minds

The other part of my job is guiding groups of visitors around the facility and assisting with educational sessions for school children. During the summer months, many inner-city kids visit. Many of these children don't get the opportunity to come to the beach very often, and it is one of the most satisfying experiences to watch them fall in love with the ocean.

We start the educational sessions with a lecture and slide show about a variety of topics, which can include sharks, the habitat of Santa Monica Bay, or the effects of pollution. Then we move on to different kinds of activities.

One of the activities the kids enjoy is the scavenger hunt. We take them through the aquarium as they try to find things like an animal that looks like a plant (the sea anemone), or a fish with poison packed in its fin (the scorpion fish). After the hunt, they draw their favorite animals and write down what they have learned about them.

Touching Lives

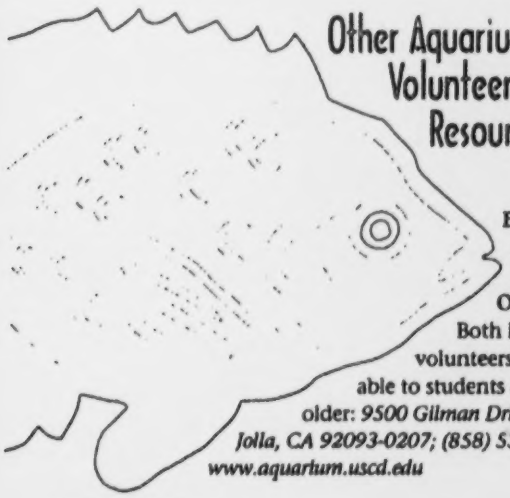
Another activity is the beach cleanup. We take plastic bags for trash and recyclables, put on rubber gloves, and head for the shore. My favorite trip was when a little blonde girl with big glasses and blue eyes picked up a bunch of cigarette butts and said, "This is so disgusting! I'm never going to smoke because it pollutes the beach so much." That's when I knew what I was doing would have a lasting effect. Not only was she making a smart decision about her health, but she was making the connection between what she did back home in Los Angeles and what was happening in the water. Until then, she may not have realized that the candy wrapper she threw down in her front yard might end up on the beach. And while it may sound like a lot of work, I always know the kids had fun when I receive the thank-you letters with backward "E"s and "S"s, telling me how great their trip to ODC was.

It isn't only school children who come to the ODC. We get many tourists from out of town, some of whom have never seen the ocean. I still get a thrill when an adult who has never seen a shark before wants to learn all about them from me.

Whether you are a volunteer or a visitor, the Ocean Discovery Center provides a wonderful environment for learning and growing. Volunteering at the ODC has truly changed how I see the world. Not only have I learned about the oceans and what fills them, but I'm no longer the terrified young girl I was on my first day of volunteering. I am confident and ready to interact with many different kinds of people in many situations. That's the kind of lesson I can carry with me in everything I do.

For more information, contact the UCLA Ocean Discovery Center, 1600 Ocean Front Walk, Santa Monica, CA 90401; (310) 393-6149; fax (310) 393-4839; www.odc.ucla.edu

Maria Saltzman is a 17-year-old senior at Santa Monica High School. When not volunteering at the ODC, she enjoys playing water polo. In January, she will travel to Australia to spend a year as an exchange student.



Other Aquarium Volunteership Resources

Birch Aquarium at Scripps Institution of Oceanography
Both internships and volunteerships are available to students age 16 and older: *9500 Gilman Drive #207, La Jolla, CA 92093-0207; (858) 534-5604; www.aquarium.uscd.edu*

Mystic Aquarium
Volunteers must be at least 15 years old: *55 Coogan Boulevard, Mystic, CT 06355-1997; (860) 572-5955 ext. 213; info@mysticaquarium.org; www.mysticaquarium.org*

National Aquarium in Baltimore
Volunteers must have completed ninth grade and a high school biology course for the Summer Student Program: *501 E. Pratt Street, Baltimore, MD 21202; (410) 576-3886; volunteer@aqua.org; www.aqua.org/education/students/*

New England Aquarium
Volunteers must be at least 16 years old and at least 18 years old to work hands-on with the animals: *Central Wharf, Boston, MA 02110-3399; (617) 973-5200; www.nea.org/corner/vol/index.html*

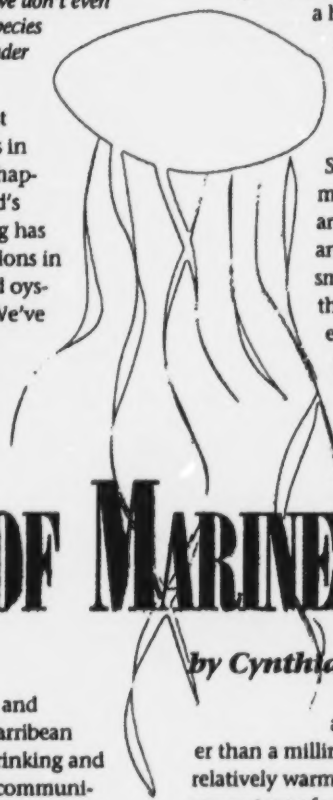
New York Aquarium
Students age 15 and older may volunteer as docents: *Boardwalk & W. 8th Street, Brooklyn, NY 11224-2899; (718) 265-3400; www.wcs.org/action/*

The Seattle Aquarium
Students ages 15–18 may volunteer in the Summer Naturalist Program: *1483 Alaskan Way, Pier 59, Seattle, WA 98101-2059; (206) 386-4320; www.seattleaquarium.org*

Shedd Aquarium
Sixteen- and seventeen-year-olds may participate in the summer interpretation internship: *1200 S. Lake Shore Drive, Chicago, IL 60605-2490; (312) 939-2426; www.sheddnet.org*

CENSUS OF MARINE LIFE: ASSESSING AND

Human civilization may prove to be the deadliest episode in Earth's history. Human pollution and depletion of plant and animal resources are causing widespread extinctions as cataclysmic as the disappearance of the dinosaurs. What's worse, we don't even know about many of the species we're destroying; they're under water.



Some of the greatest ecological changes in recent years have happened in the world's waters. Overfishing has caused vast reductions in cod on Georges Bank and oysters in the Chesapeake. We've lost species like sponges and other invertebrates with potential medical benefits. Rare and beautiful coral reefs in Hawaii and Florida and near many Carribean and Pacific islands are shrinking and bleaching. Some marine communities, such as parts of the Chesapeake and the Peconic Estuary in eastern Long Island, have switched from a phytoplankton base to a bacterial base. Sadly, those are just a few of the examples that we know about.

The Web of Life

We destroy other life forms at our peril. Organisms that we pay no attention to may make this planet habitable for humans. Through their metabolism and interactions, they affect the chemistry and physics of the planet in a way that has allowed humans to evolve and survive. Some examples that we know about include the oxygen-producing abilities of plankton—some highly oxygenated waters sink in the north polar region and emerge hundreds of years later in the Pacific—and the settling of living organisms into deep sea sediments, where bacteria break them down into carbon and release it over long time periods. But the part that any one life form plays in our natural system is still unknown and could be greater than we guess. Since marine species make up a huge part of these life forms, to protect them and their habitats is ultimately to safeguard the survival of humans.

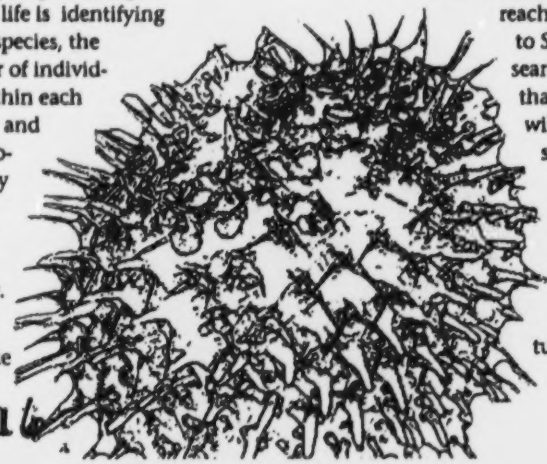
Scientists know that many marine plants and animals are decreasing in number and living in smaller and smaller areas. We also know that many species will go extinct if we don't stop polluting the waters and destroying coastal habitats. Although we know a lot about life forms larger than a millimeter living in shallow, relatively warm areas, that's only a small percentage of marine life. Some scientists estimate that as many as 25% of fish species and 75% of marine meiofauna species— benthic invertebrates between 1 mm and 63 microns in size—are currently unknown to us. Until you know a species is out there, you can't understand its role in the ecosystem or take steps to save it from extinction. Therefore, the first step in protecting marine life is identifying all the species, the number of individuals within each species, and how biodiversity keeps marine life healthy. That's what the Census of Marine Life (CoML) is all about. During the next 10 years, CoML will generate extensive data on the world's marine communities in order to track future changes. We hope to take an inventory of the different species, the number of individuals within each species, and how they are distributed in space and time. The census will be vast, covering all life forms from shrimp-like creatures small enough to live between sand grains, to big game fish and whales.

Census in Action

It is not physically possible, even in 10 years, to count all the organisms in the ocean. So we'll spend five to seven years intensively sampling in a selection of regions and habitats throughout the world. Possible locations include well-known areas like Georges Bank off New England and less familiar places like deep sea hydrothermal vents and seamounts in the mid-ocean. Marine scientists from Japan, Norway, Canada, Australia, and India—to name a few—will help design and carry out this research.

Much of our sampling will involve traditional collection methods like nets and grabs, but technology has provided new ways of better "seeing" the organisms in the oceans without disturbing them. Deep-sea submersibles and autonomous underwater vehicles (AUVs) reach depths impossible to SCUBA divers and search more precisely than a net. Technology will also allow us to study marine habitats from a distance. New kinds of sophisticated radar can locate schools of large fish, such as tuna, from satellites

by Cynthia J. Decker, Ph.D.



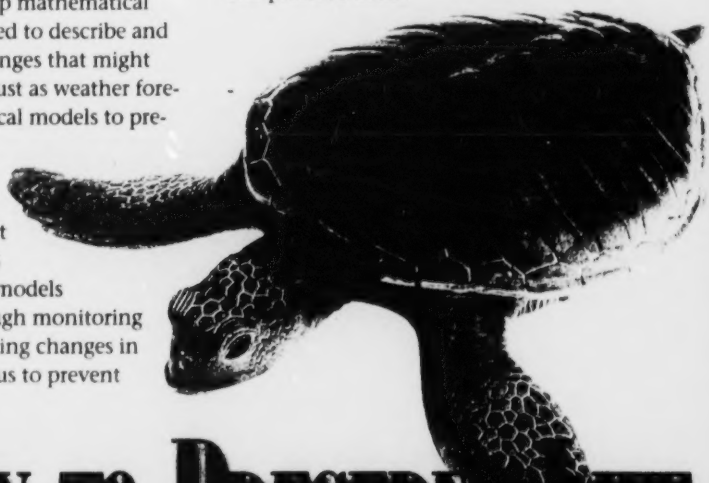
orbiting the earth. Sensors, mounted on buoys or inserted into the sediment, will use light or sound to make images that can be sent via acoustic modems to antennae above the water that send signals to communications satellites.

Once the sampling is finished, we'll use the information to extrapolate data about the places we could not study. The goal is to develop as complete a picture of the world's marine life as possible. We also hope that the data we collect will help other programs design and carry out long-term monitoring. Such programs will eventually be able to measure changes in biodiversity over periods of time.

Brave New Waterworld

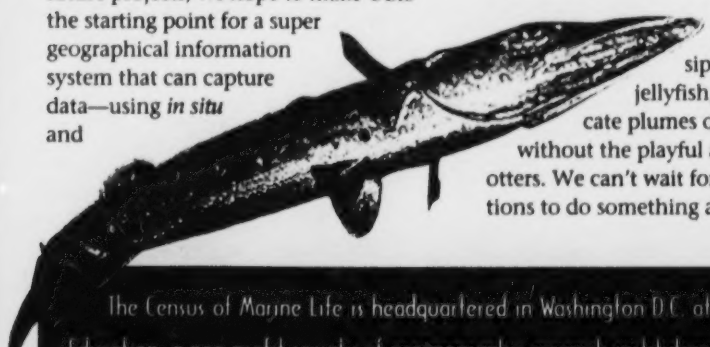
One of the projects that CoML has already started is the Ocean Biogeographical Information System (OBIS). OBIS is a network of computers that will collect, synthesize, and disperse information about our oceans via the Internet. Using the biological data collected by past researchers, CoML, and future projects, we hope to make OBIS the starting point for a super geographical information system that can capture data—using *in situ* and remote sensors—in real time. The data can then be instantaneously transferred to oceanographers, marine biologists, or anyone else who might want it. Such technology is still a dream, but OBIS is the first step in making it a reality.

CoML will also develop mathematical models that can be used to describe and eventually predict changes that might occur in ecosystems. Just as weather forecasters use mathematical models to predict the formation and movement of air masses, scientists might someday predict changes in ecosystems by applying the right models to data collected through monitoring programs. And predicting changes in ecosystems will allow us to prevent those changes before they happen.



EXPLAINING DIVERSITY TO PRESERVE IT

The Earth is unique. Its many life forms make it both magnificent and mysterious. Simply put, each time a species is lost, our world becomes a poorer place. I hate to imagine a world without the long drifting form of a siphonophore or jellyfish, without the delicate plumes of a sea fan, or without the playful antics of sea otters. We can't wait for future generations to do something about the extinctions that are already in progress. The scientists involved in CoML hope that by collecting data on marine biodiversity and making it available to everyone, people will learn enough about the oceans and the lives within to protect and preserve them.



Dr. Cynthia Decker is the Associate Director of the Consortium for Oceanographic Research. She received her Ph.D. in oceanography from the State University of New York at Stony Brook and worked at the Office of Naval Research and the NY State Department of Environmental Conservation before coming to CORE.

The Census of Marine Life is headquartered in Washington D.C. at the offices of the Consortium for Oceanographic Research and Education, a non-profit society of oceanographic research institutions. CORE manages the overall census program with advice from a scientific steering committee and other subcommittees on specific topics as needed. CORE is also responsible for overall communications and outreach. For more information, contact the Consortium for Oceanographic Research and Education, Suite 800, 1755 Massachusetts Ave. NW, Washington, DC 20036; (202) 232-3900; fax (202) 986-5072; core@brook.edu; http://core.cast.msstate.edu

MORE THAN JUST WATER:

The National Ocean Sciences Bowl

by Amanda Bowling and Laura Orem

What is the phylum of marine organisms that use stinging cells, or nematocysts, for protection and food gathering?

Monterey, CA, was a favorite haunt of what author in numerous books and stories? ***The Strange Case of Dr. Jekyll and Mr. Hyde?***

What is the name given to those areas of the earth that do not receive seasonal changes from a particular earthquake event?

If, at your location, it is 5:30 on March 1, Mean Time at local astronomical noon, what is your longitude?

At first glance, these questions may not seem to be related. But for participants in the National Ocean Sciences Bowl (NOSB), the connection between marine biology, literature, geology, and geography, as well as many other disciplines, was clear. That connection can be found in the world's oceans.

The NOSB is an annual competition for high school students, sponsored by the Consortium for Oceanographic Research and Education (CORE), in cooperation with 58 member institutions and in partnership with the National Marine Educators Association. Its goals are to nurture the next generation of marine scientists, educators, and policy makers as well as to raise the public's overall understanding of the oceans as a resource. To achieve this, the NOSB wants students to realize that all disciplines, whether in the sciences or humanities, have a direct relationship with the ocean sciences.

This year, approximately 1,300 students from 300 U.S. high schools competed in 20 regional competitions across the country. Each team was comprised of four students and a coach; the 20 regional winners met outside of Washington, DC, in April for the finals.

One of the regional winners was the Gilman School from Baltimore, MD. Karthik Balakrishnan, a science teacher and coach of the Gilman team, started with four students who had some general experiences with marine science, including keeping fish as a hobby, kayaking, sailing, and setting lobster traps in Maine, and an interest in environmental science and biology.

"To prepare for the regionals, we studied in a very general way to refresh our knowledge of things we already had experience with.

Gilman won their regional competition but the finals were harder. The questions in the finals were very broad ranging," says Balakrishnan. "There were a lot of questions about meteorology, climate, everything from literature to conservation to identifying a particular species of fish. They ratcheted CORE's interest in having the students see how the ocean sciences impact everything, how everything is interconnected.

The focus of the competition was not just geologic or natural history, but what is happening in the oceans now. This "current events" approach served to stimulate students' interest in an organized way, enabling them to relate ocean sciences to their specific areas of interest. To further aid students in this way, the NOSB provided information booths at the competition on everything from internships to classes to careers in the ocean sciences. In addition, the NOSB supplied a suggested reading list of publications that cover the ocean sciences, including *Science News* and *Scientific American*.

Continued on page 18

Other Resources in Marine Science

EDUCATIONAL OPPORTUNITIES

The JASON project
www.jasonproject.org
Founded by Dr. Robert Ballard, the man who discovered the sunken *Titanic*, JASON is a year-long scientific expedition that links middle-school classrooms with scientists in the field. Via the Internet and live interactive broadcasts, students follow the scientists' progress. Students also conduct their own experiments based on what they learn. The program includes teacher training and a full curriculum.

Expedition sites have included Belize, Iceland, the Galapagos Islands, and Peru; JASON XII, the 2000 expedition, is focusing on the volcanoes of Hawaii.

WEB SITES

The Bridge
www.vims.edu/bridge/
This is a great place to start if you have an interest in marine science and want to learn more. This site has links to nearly every marine science site imaginable. Categories include Student Opportunities, On-Line Publications, Student Project Pages, and Academic Programs.

Careers in Oceanography, Marine Science, and Marine Biology
http://scilib.ucsd.edu/sio/guie/career.html
Complied by Scripps Institution of Oceanography, this career directory has links to dozens of sites of interest to aspiring marine scientists.

Marine Careers
http://marinecareers.net
You can link to this site from the one listed above, but we thought it deserved its own listing for its extensive collection of career profiles from a wide range of marine sciences.

Ocean Planet
http://seawifs.gsfc.nasa.gov/ocean_planet.html. You could spend hours exploring this on-line exhibition, which contains all the text and most of the panel designs and images found in an exhibition held at the Museum of Natural History a few years ago. The special tour designed by the curator is a good place to begin.

Volunteering for the Coast
http://volunteer.nos.noaa.gov/
This site feature a searchable database of volunteer opportunities, some inspiring success stories, and resources for both volunteers and those who want to become volunteers in their own communities.

BOOKS

Cetacean Societies by Richard C. Connor (ed.) et al. (University of Chicago Press, 2000).
Until recently, we knew little about the lives of dolphins and whales aside from how they act near the surface of the water. This book offers a glimpse of these marine mammals in their natural habitats, thanks to new research methods that go beneath the waves.

The Enchanted Braid: Coming to Terms with Nature on the Coral Reef by Osha Gray Davidson (John Wiley & Sons, 1998).
Both a biological exploration and a historical survey (beginning with Darwin's first views of the reefs), this book provides a good introduction to coral reefs and makes clear the reasons we should work to preserve them.

The Eternal Darkness: A Personal History of Deep-Sea Exploration by Robert D. Ballard (Princeton University Press, 2000). Robert Ballard, perhaps best known for his discovery of the *Titanic*, recounts this and many of the other deep-sea expeditions he undertook during his 30 years at Woods Hole Oceanographic Institute.

A Fish Caught in Time: The Search for the Coelocanth by Samantha Weinberg (HarperCollins, 2000).
In 1938, a young curator came across a fish unlike any she'd ever seen—perhaps because it was believed to have been extinct for 70 million years. This scientific thriller tells the story of the coelocanth through its most recent (supposed) sighting in 1998.

Killer Algae by Alexandre Meinesz (University of Chicago Press, 1999).
A frightening tale of what can happen when otherwise harmless species end up in the wrong environment, *Killer Algae* shows the results of dumping a mere bucketful of non-native algae into the Mediterranean Sea.

The Restless Sea: Exploring the World Beneath the Waves by Robert Kunzig (W.W. Norton & Company, 1999).
What was it like to find life on the ocean's floor? This book takes readers on a journey beneath the ocean, allowing them to share in the excitement of discoveries made by generations of oceanographers.

Ocean's End: Travels Through Endangered Seas by Colin Woodard (Basic Books, 2000).
Don't expect an uplifting story here; instead, expect an unflinching look, with a shocking array of examples, at how humans are killing the oceans.

The Sea Around Us (Special Edition) by Rachel Carson (Oxford University Press, 1991). Decades after this book won the National Book Award in 1951, its topic is still relevant. The special edition updates the science of the book with a new chapter written by a marine ecologist.

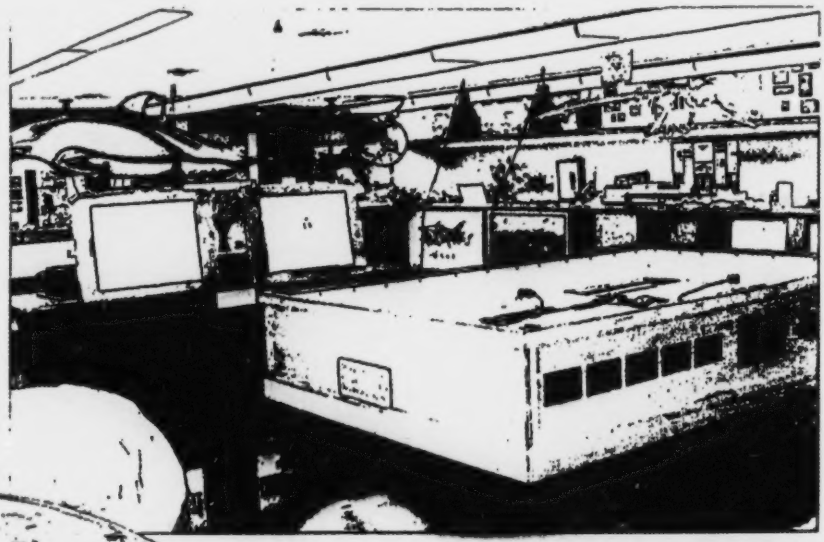
Song for the Blue Ocean: Encounters Along the World's Coasts and Beneath the Seas by Carl Safina (Henry Holt & Company, 1998).
Author Carl Safina, marine scientist and founder of the Audubon Society's Living Oceans Program, describes the state of the oceans and their inhabitants—and the role of humans, especially commercial fisheries, have played in their destruction.

BEST COPY AVAILABLE

Behind the Tanks of the Cal

Interview with Mathew Rambo, Head Curator

by Melissa Hartman



You're winding through the exhibits at the aquarium: one minute you're eye-to-eye with a wood frog in the rainforest, and the next you're running your fingers over a sea cucumber in the touch tank. You feel far away from your everyday world ... and then you remember that you haven't even left school.

At the Cabrillo High School Aquarium in Lompoc, CA, students not only enjoy the exhibits but also create them. From acquiring and caring for the animals to writing grant proposals and making fund-raising speeches, the students do it all. The results of their efforts—an array of elaborate exhibits that will move into a million-dollar facility this fall—attract thousands of visitors a year. We asked Matt Rambo, who worked at the aquarium for all four years of high school, to tell us what it was like to work at the country's only major high school aquarium.

How did the Cabrillo High School Aquarium get started?

The aquarium began in 1986 when a student named Sagar Gupta approached one of our teachers, Mr. Long, with an idea for a science project. He wanted to develop a warm water reef so that he could evaluate different types of aquarium filters. Together they developed our first display for the purpose of studying trickle filters. Since then we have grown tank-by-tank, and we will be moving into our new facility in the fall. It will be more than three times the size of our current facility and will feature state-of-the-art aquarium equipment.

What exhibits do you now have at the aquarium?

We have every type of display you could think of, from a splash tank to a rainforest. Tanks range in size from 20 gallons to 375 gallons. Other displays include various tropical salt water tanks, a Frontosa display, touch tank, hospital tank, central California reef tank, eel tank, trout hatchery, lobster tank, underwater submersible equipment tank, and my favorite, the freshwater gamefish tank. This includes a spotted bass, which we are studying for predatory habits so we can determine what kind of lure works best. I am a fisherman, so I particularly like this display. Other animals in our facility include sharks, eels, lobsters, frogs, turtles, octopi, various exotic saltwater fish, and crabs—basically anything you would find in temperate or tropical waters.

How do you acquire the animals?

The aquarium has a Scientific Collections permit, so we can collect many specimens on our own. We have a strong partnership with the local Vandenberg Air Force Base, which allows us to access the coastline there. Since I live on the base, I usually go out to collect animals, either with a dip net or my bare hands. Certain displays, such as the splash tank, are made up entirely of animals that I have collected from the Vandenberg coastline over my four years at Cabrillo: a two-spotted octopus, many opaleye surfperch, a lot of sculpins, some pricklebacks, rock crabs, shore crabs, hermit crabs, black

rillo High School Aquarium

and brown turban snails, giant green anemone, aggregating anemone, chitons, limpets, periwinkles, ochre stars, bat stars, California cones, and California brown sea hares. I have also collected wood frogs for our rainforest exhibit.

Pet stores and local hobbyists donate animals we can't get from our coast. Other aquariums, like Monterey Bay Aquarium, and research facilities, like Diablo Canyon Power Plant, also give us certain species.

Have you had any particularly memorable experiences with any of the animals?

I think the most memorable animal we've had during my time here was the two-spotted octopus I caught. That octopus was an escape artist and was always crawling out of his tank and going into the surrounding tanks to eat. Sometimes we would come into the aquarium in the morning and find him crawling around on the floor. We solved this problem by surrounding his tank with astro turf, which his suckers couldn't grip.

His body was about the size of a man's fist and his arms were extremely strong, so whenever we tried to feed him, we would have a tug of war match with him trying to get our hand or prong back. We had him for about two years when he died of old age—octopi have a very short lifespan, and we were surprised by how long he lived.

Besides your school's students, who visits the aquarium?

We give tours to elementary school students every Wednesday at lunch. We also give tours to special community visitors, and we hold open houses twice a month for the whole community. More than 10,000 people and more than 100 special visitors tour the aquarium over the course of a year. The numbers are increasing as we get closer to moving into our new facility.

Who cares for the animals?

The aquarium is run entirely by students in the Aquarium Club. Our nutrition curator and his staff are in charge of feeding, which is done mostly on Monday, Wednesday, and Friday. He is also in charge of our hospital tank and generally keeping the fish. Our tourism curator, with the help of her staff, runs the tours. Our maintenance curator runs our workdays on Tuesday and supervises the daily upkeep of the tanks.

How did you become head curator? What does that position involve?

The head curator is chosen by the board of directors, which includes select school and community leaders. They consider how long you've been there, how hard you work, how much you know about the aquarium, your leadership skills, Mr. Long's recommendation, and the previous head curator's recommendation. I have been head curator for two years.

I run the aquarium just as you would run a major business. Like the CEO, I report to the board of directors, and I have a chain of command beneath me that includes the assistant curators, or executives, then the managers, then the workers beneath them. Each executive is in charge of a specific function of the aquarium, such as tourism, nutrition, or maintenance.

In addition, I serve as the aquarium representative in many situations. Along with two of my assistant curators and Mr. Long, I took an all-expense-paid trip to Washington, D.C., courtesy of the National Oceanographic and Atmospheric Administration (NOAA). The purpose of this trip was not only for us to learn about NOAA and its role in our government, but, more importantly, for us to explain how our aquarium demonstrates cross-curricular education and what its benefits are.

I have also given many speeches, including several to request funding; and, as a student representative in the community, I speak on such topics as the impact of beach closures on education.

Do you have any interaction with professional aquarium curators?

We have a strong partnership with Monterey Bay Aquarium. The founder, Dr. Webster, often talks with and offers guidance to students. We visit Monterey Bay once a year to get lessons on aquarium upkeep and ideas for improving our program. We actually stay the night at the aquarium. We have always had lots of fun doing that.

What have you learned by working on the aquarium? How might you use this knowledge in the future?

Working at the aquarium has taught me advanced aquarium keeping skills, including building and repairing filters, tanks, and lights, and setting up a successful aquarium habitat. I have also learned the correct way to do research, collect animals, and apply for grants.

But the public speaking skills I have developed over my time at the aquarium are what I am most proud of. I enjoy being in front of a crowd and speaking. I would like to do that in my future career, working in an aquarium or anywhere that I can both speak publicly and work in marine biology.

To find out more about the Cabrillo High School Aquarium, visit their Web site at http://site.yahoo.com/cabrillo/index.html

***Mathew Rambo** is now a freshman at Texas A & M University, where he plans to major in marine biology. He hopes to start working part-time at Moody Gardens Aquarium in Galveston as well.*

ALL THE WORLD'S A STAGE:

My Life as a Thespian

by Laura J. Khalil

When I was in fifth grade, I saw a high-school production of the Andrew Lloyd Webber musical *Joseph and the Amazing Technicolor Dreamcoat*. I was dazzled by the colorful sets and the bright costumes. The music was so stirring that I could hardly stay in my seat. But what I loved best was the energy of the players. I had seen live theater before, but this performance gave me chills. I dropped my childhood plans of becoming a scientist and, determined to have the powerful effect on audiences that the cast of *Joseph* had on me, resolved to become an actress.

From that day forward, I began reading every issue of the high school newspaper just to find out more about the thespian troupe. In a slightly worn pink folder (formerly used for biology notes) I stored every article I could find about Boswell High School drama. I longed to be a part of it.

Something Fun for Everyone

At my first Thespian meeting in the ninth grade, the drama director told us about The International Thespian Society (ITS). ITS is the student counterpart to the Educational Theater Association, and its purpose is to introduce students to the exciting and varied experience of theater. But ITS offers more than drama. Many students join ITS for the *esprit de corps*. In addition to producing plays, each troupe has its own traditions and activities that range from fundraising and volunteer work to lock-ins and video scavenger hunts.

Lock-ins at my high school were like theatrical 3-ring circuses. Participants arrived at the theater at around 9:00 p.m. At 11:00, the doors were locked and not opened again until 6:00 the next morning. On stage we held improv contests as well as swing dance and sword-play lessons. The side stages were transformed into make-up rooms and art studios while the arena theater became a dance club. Other rooms held video and board games or movies. There was definitely something fun for everyone.

At Home with Kindred Spirits

Thespians are an incredibly diverse group of students who set aside differences in order to come together and share a common passion for their art. This is evident at Thespian festivals, where there is no such thing as a stranger and all who attend feel at home with kindred spirits. A Thespian festival is the most energy-packed event I've ever attended.

At the six-day international festival, currently held in Lincoln, Nebraska, over 30 thespian troupes present musicals and full-length plays in two separate theaters. There's almost always a performance to watch. When not watching or participating in performances, delegates can join in on any one of approximately 75 workshops covering topics and skills such as body movement, stage combat, and how to make costumes out of thrift-shop clothing.

At both the state and international levels, single performers and small groups also compete in individual scenes. One of my favorite memories from the 1999 Texas Festival was performing "Big Spender" from the musical *Sweet Charity* with 11 other women on the main stage in front of 1,800 delegates. Our Bob Fosse-style choreography, provided by my best friend Brandon, got us a "superior" rating and a standing ovation.

Between shows and workshops, thespians from different troupes, states, and countries can be found sitting in the grass playing ice-breaker games or having philosophical discussions. However, my favorite part of Thespian festivals is listening to applause for a show well done. Time seems to stand still as the sound resonates, an audible expression of the energy generated by the interaction between performers and audience.

A Way of Life

Over the years, theater has become my way of life. While most of my theater experience has revolved around the International Thespian Society and Texas Thespians, I have tried theater in other venues. For two years I was a member of Teen Drama. We used performance to educate other teens about issues like drug abuse, pregnancy, and suicide. I was amazed at the interest I saw on the audiences' faces and at the number of questions they asked after every show. I can't think of a better way to do community outreach.

In the summer of 1999, my theatrical "outreach" extended all the way to Cambridge, England, where I studied drama through a program called The Cambridge Tradition. With our British counterparts, we spent a lot of time laughing at each other's funny accents and expressions, but when it came down to it, we were all speaking our common love of theater.

That love of theater is what being a thespian is all about. Theater is a home for many people who don't feel at home anywhere else. It provides an outlet for their creativity and a release for their joy and pain. It's a place where you can find others who share the same sense of beauty and expression. Through my various theatrical experiences, I have been fortunate enough to befriend some of the most gifted and supportive people I've ever met, and they have inspired me to strive for greatness. Theater is my passion and my calling because of its potential to touch lives, and I know this every time I stand on a stage.

*Since 1998, **Laura J. Khalil** has served Texas State and International Thespians as a board member, chairperson, state representative, and student liaison. This May, she graduated from Boswell High School in Fort Worth, TX, and is currently a freshman at Yale University majoring in film and drama. When not on stage, she enjoys painting in acrylics and black-and-white photography.*

THE INTERNATIONAL THESPIAN SOCIETY

ITS is an honor society for theater students worldwide. Students join Thespian troupes at their high schools and may attend various regional, state, and international theater festivals. Not all members of ITS are actors or actresses. Some of the most outstanding members of ITS focus on the technical aspects (stage managing, set design, costuming, sound, lighting) of theater and have never performed for an audience.

The only requirement for becoming a Thespian is a love of all aspects of theater, from dance to acting to rigging the lights and everything in between.

For more information, contact the Educational Theatre Association, 2343 Auburn Avenue, Cincinnati, OH 45219-2819.; (513) 421-3900; www.etassoc.org

Behind the Curtain: A Techie at the Theater

by Dave Kavulak

It is always very quiet backstage right before the start of a production. The curtain is closed and soft blue light is the only illumination. The stage hands move silently in the wings and the actors quietly whisper their opening lines. Through the curtain I can hear the general mumble of the crowd as audience members take their seats, fold jackets over the backs of chairs, and browse through their programs. The stage manager gives the "all-go" from stage right, the blue light dies out, and we are all plunged into complete darkness for a second. Then, as the curtain rumbles open and the lights come up, Tevyeh steps forward to tell the story of a poor Jewish town in the heart of Russia in *Fiddler on the Roof*.

I am a theater technician for the drama program at Thomas Jefferson High School for Science and Technology in Fairfax, Virginia, a magnet school for students interested and gifted in the sciences and engineering fields. It may sound kind of funny, having a drama program at a science and tech school, but, like many of our productions, *Fiddler on the Roof* was a great success. We sold out three of the four nights of the production; the only reason the fourth night wasn't a sell-out was due to a freak snowstorm that made some people assume the show had been canceled.

Getting Involved

I joined TJ Drama at the beginning of my freshman year when a friend of mine dragged me to an interest meeting. While I was intrigued by the technology aspects of the show, I really went because I had a crush on one of the actresses. After that first meeting, I stopped by the auditorium every few days to see if I could help paint publicity flats or build a wall for the set. I thought that by showing up I could get to know her better.

Well, I will have to thank that actress some day. While I started working in theater because of her, I stayed involved in drama throughout my entire high school career because of the great people, the challenges, and my growing love of theater as an art. I started out as part of the construction crew, helping to drill, cut, and build the sets, and during the second show of my freshman year I made it onto the stage crew for our annual revue, *Knight of One Ax*.

Since then I have been a sound designer, technical director, and stage manager for various productions. TJ Drama is a completely student-run organization; all positions, from technical heads to publicity to house manager, are filled by students. We do have an adult sponsor who oversees the whole production and acts as the director to the two full-length shows we have a year, but the nuts-and-bolts work of putting on a production is done by the students. The club is headed by a council of presidents, a five-person (seniors and/or juniors) council elected by the club. The council helps to pick the heads of all departments for each show and oversees the club's treasury. All set design, light design, costuming, makeup, and technical aspects are done

by students. I have been constantly astounded by the professional quality and effectiveness that we achieve.

The Show Must Go On!

When I hear how hard it is for many friends of mine who participate in school sports, such as basketball, soccer, football, and track, to commit the time and effort it takes to excel, I just smile and keep quiet. We theater members stay after school every day until 6:30 p.m., working on construction for the set to our next show. Then add in every Saturday for at least four hours, as well as an hour and a half during the school day several times a week.

But this is nothing compared to the few weeks right before a show, especially the week of the show. Then, as soon as school lets out for the day, I rush to the auditorium, throw my backpack into a corner next to the tech booth, and don't leave until eight, nine, or ten o'clock at night. And we don't stop, not even for dinner. Most of these nights you'll find us onstage with a slice of cheese pizza in one hand and a drill in the other.

It sounds like a lot of time, effort, and stress to willingly put yourself through, even before you start your homework. But I don't think so. There is no place I would rather be on a Wednesday night at nine o'clock than with my friends, hanging tombstones from the grid of the ceiling twenty feet up in the air for the dream scene in *Fiddler*, or making a circular staircase for *The Man Who Came To Dinner*.

Technical Magic

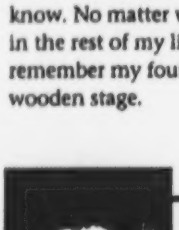
The challenges that theater offers are stressful, but exciting. During the winter of my senior year, I found myself as technical director for *Fiddler*, our largest musical in at least five years. This play alone requires over 60 actors/chorus members, over 20 musicians, and 30 technicians to produce.

As the technical director, it was my job to design the sets and see that all other technical aspects of the show were met precisely and on time. I had to lead design discussions, get people organized and start them building sets, as well as meet with the directors on a constant basis to be sure that the set we were building was the same one they were blocking for. This show had over 20 scene changes that each had to be accomplished in under half a minute, as well as a flying actress for a ghost scene, lights that changed colors to the beat of the music, and stools that could be broken over an actor's back, just like in the movies. Overall it took hundreds of hours to design and build with lots of help from many students. It was one of the greatest times I have ever had. Working on something this large with great people and having it come out so well that we astounded our audience is what real theater is all about.

Making Friends and Memories

TJ Drama is made up of almost 30 technicians and 30 actors, and we are like a family. When I first arrived at Thomas Jefferson, I knew less than 20 other students, all of them freshmen like me, and I'd said no more than ten words to most of them. But the members of TJ Drama soon became my friends. I began to know seniors when I was still a freshman, and now as a senior I count many freshman among my closest friends. I don't think that I would have ever managed this outside of this organization that brings together so many different people.

High school theater has also given me a greater love for the dramatic arts than I have ever had before. Now I find myself reading full-length plays instead of mystery novels, and going to see productions at local community theaters as well as other high schools instead of watching movies on Friday nights. TJ Drama has changed my life and allowed me to interact with some of the greatest people I know. No matter what I do in college or in the rest of my life, I will always remember my four years on that black wooden stage.

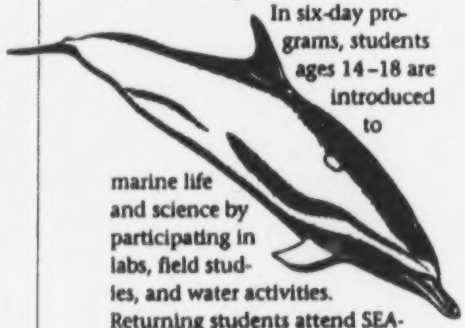


David Kavulak graduated from Thomas Jefferson High School in May. He enjoys soccer, basketball, and ultimate frisbee. He will attend the University of Virginia starting in the fall, where he hopes to major in either theater or chemistry.

Other Summer Programs—from page 11

14–17 and 18+ (participants are grouped by age), emphasize a detailed marine science curriculum and underwater activities designed to teach methods of collecting ecological data. Students participate in ongoing research efforts and also have opportunities to work on independent projects.

SEACAMP (California)
Note: this is a separate program from Seacamp in Florida.



In six-day programs, students ages 14–18 are introduced to marine life and science by participating in labs, field studies, and water activities. Returning students attend SEACAMP II, a more challenging and self-guided program. For more information, contact SEACAMP San Diego, 1380 Garnet Avenue, PMB E6, San Diego, CA 92109; (800) SEACAMP; seacamp@seacamp.com; www.seacamp.com

The Whale Camp
P.O. Box 63, Cheyney, PA 19319; (888) 54-WHALE; info@whalecamp.com; www.whalecamp.com
Students ages 10–17 may choose from one- to four-week sessions that incorporate whale and marine mammal observation, sailing, regional ecology and geology, marine and cetacean studies, environmental science, oceanography, aquaculture, and history and folklore of the region. The Whale Research Camp is located on Grand Manan Island between Maine and Nova Scotia.

Off The Shelf

Galileo's Daughter by Dava Sobel

by Laura Owen

In February 1633, while in Rome waiting to appear before the Inquisition, Galileo Galilei received a letter from his eldest daughter. Suor (Sister) Maria Celeste was a nun in the Convent of San Matteo, just south of Florence, and Galileo had left her in charge of his domestic affairs while he was away. The letter dealt with bill-paying, buying linen for a tablecloth, and decanting some barrels of wine in Galileo's cellar. There was good news about the garden, too: a nice crop of lettuce and bitter oranges. There was no direct mention of the impending trial. What made the letter exceptional was the signature: *Suor Maria Celeste Galilei.*

She had never used her complete name before. By doing so now, Suor Maria Celeste was leaving herself open to the same charges of heresy and blasphemy her father was facing. Signing her last name was an act of solidarity with the father she loved; it was also an act of great courage. In *Galileo's Daughter,* author Dava Sobel has collected all 126 of her surviving letters and tells the story of the Galilei family, a remarkable story of love and loyalty.

Sobel's book illuminates a part of Galileo's life that may not be familiar to many readers. We know him as the inventor of the telescope, a proponent of the Copernican model of the universe, and the victim of a Church that found his scientific ideas heretical and dangerous. But we may not know of the devoted family man who depended on a rich and supportive relationship with his three children: Virginia, born in 1600; Livia, born in 1601; and Vincenzio, born in 1606.

Galileo never married their mother, Marina Gamba of Venice, and as the custom of the day dictated for illegitimate girls, both Virginia and Livia entered religious life in their early teens. Despite their cloistered existence, Galileo maintained close contact with them, visiting often, sending money and presents, and corresponding regularly with Virginia, who, as Suor Maria Celeste, rose to a position of authority as the convent's apothecary. Galileo seems to have had a special relationship with his eldest daughter. She eagerly awaited copies of his books, sewed and bleached his linen collars, baked him sweets, concocted remedies for his myriad aches and pains, and sent him samples of her own writing. The depth of their love for each other became clear when Galileo was brought before the Inquisition for suggesting in his book, *Dialogue on the Two Chief World Systems,* that Copernicus had been correct: the sun moved around the earth, and the heavens were not immutable, but changeable. By doing so, Galileo directly challenged the Church's position that the Ptolemaic, or Earth-centered and static, model of the universe reflected God's divine plan.

Sobel intersperses Suor Maria's letters with the story of Galileo's persecution, and it is obvious how much his daughter's support and encouragement must have meant to him at a time when he was facing excommunication and possible execution:

> *I enjoy your good fortune more than my own, not only because I love you more than myself, but also ... (beyond the fact that you do so much good and are able to help so many others) because the great intellect and knowledge that the Lord God has given you enables you to serve Him and honor Him far more than I ever could.*

Threatened with torture and death, Galileo was forced to recant his scientific theories. He was placed under house arrest for the remainder of his life. When news of the verdict reached Suor Maria, she immediately wrote to him:

> *So intensely did it pierce my soul with pain to hear that judgement has finally been passed ... Since you ... can lay claim to full cognizance of the fallacy and instability of everything in this miserable world, you must not make too much of these storms, but rather take hope that they will soon ... transform themselves from troubles into as many satisfactions.*

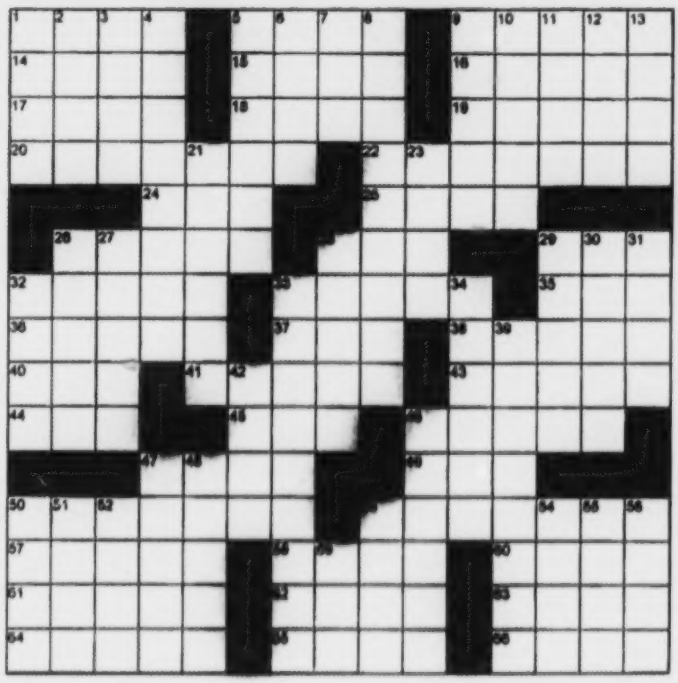
Unfortunately, as Sobel points out, Galileo's future wasn't the only thing damaged by the trial. Shortly after the verdict, Suor Maria Celeste took ill with dysentery; on April 2, 1634, she died. Galileo was distraught. She was, he wrote, "a woman of exquisite mind, singular goodness, and most tenderly attached to me ... she died after six days' illness, leaving me in deep affliction."

Blind, sick, and spiritually broken, Galileo himself died in 1642. He was hastily buried in the Novices' chapel in the Francescan church of Santa Croce, Pope Urban VII having expressly forbidden any public displays or ceremonies. Sobel reminds us that it wasn't until 1992, over 350 years after his trial and imprisonment, that Galileo was finally exonerated by Pope John Paul II.

In *Galileo's Daughter,* Dava Sobel expands our perception of Galileo from an icon of science into a three-dimensional human being. By interspersing Suor Maria Celeste's letters with Galileo's life story, she shows how the events surrounding his persecution affected an entire family. Her book serves as a reminder that history does not happen in books or museums, it happens to real people.

Word Wise: Mare Nostrum

by Carol Blackburn



ACROSS

1 Antarctic sea
5 Tier
9 Unkind nickname
14 Sea eagle
15 Atlantic alliance
16 Straight ___
17 See 57 Across
18 Gelatinous material from seaweed
19 Sea water
20 Tranquil
22 Greek for "sea"
24 Cc
25 Beasts of burden
26 Small songbirds
28 102
29 Plural noun for a group of dolphins
32 Radiate
33 Breezes
35 Whiz
36 Endures
37 Is (pl.)
38 Lost (2 wds.)
40 Island (Fr.)
41 Farms
43 Ore
44 Sea, to Debussy
45 Utter
46 Kierkegaard
47 Seaweed
49 La Brea landfill
50 Whales
53 Gentle marine mammal
57 With 17 Across, biochemical building block
58 Objective
60 Harbor
61 Flat or wave
62 Pressed (Jap.)
63 Fe
64 Pillar
65 Climb
66 Space agency

DOWN

1 Gather
2 Killer whale
3 __-snac
4 Ocean bottom debris
5 Conch shell residents
6 DNA bases
7 Arrival time
8 From the Latin for "swine fishes"
9 Story
10 Scottish island
11 Math subj.
12 Sound (It.)
13 Indebted to
21 Best
23 Outlet
26 Right or pilot
27 Early __
28 Wavy
29 Adhere
30 From the Greek name of a river thought to encircle the world
31 Do business
32 Slender
33 Giant tortoise breeding ground
34 South Pacific islander
39 Turtle
42 Coastal feature
46 Former Soviet leader
47 Man-made waterway (Ger.)
48 French school
50 Felines
51 Send out
52 Spring or neap
53 Half a tuna
54 Tiger, in Tokyo
55 Greek god of love
56 Mediterranean volcano
59 __kosh

Solution on page 29

"The seas are the heart's blood of the Earth. Plucked up and kneaded by the sun and the moon, the tides are systole and diastole of the Earth's veins. The rhythm of the waves beats in the sea like a pulse of living flesh. It is pure force, forever embodying itself in a succession of watery shapes which vanish on its passing."

Henry Beston, *The Outermost House*

Exploring Career Options:

Trauma Surgery

Interview with Edward E. Cornwell III, M.D.

by Laura Green

Dr. Edward E. Cornwell III is Chief of Adult Trauma Services at the Johns Hopkins Hospital. His unit, part of the Emergency Department, is classified as a Level-1 Trauma Center. To earn a Level-1 rating, a Trauma Center must be able to provide 24-hour care by a variety of specialists to the most severely injured patients; in addition, the rating requires that the Center be involved with public education, community outreach, and research. Over 2000 people, many of them teenage gunshot victims of gang violence, come through its doors each year.

Besides treating patients, Dr. Cornwell administers the Center and provides training and mentoring for surgical residents. On a personal level, he is active in the Baltimore City Police Athletic League, serving as a role model for the young people of Baltimore's inner city.

Have you always wanted to be a surgeon?

When I was a little boy, I wanted to be a football player (although I didn't know what that meant) and a mathematician in the off-season. My father was a surgeon, so later I wanted to become a surgeon, too. I took a lot of science in high school and pre-med as an undergraduate. But it wasn't until after my first year of medical school, when I was diagnosed with keratoconus—a serious eye condition that threatened my sight—and had a cornea transplant, that it became more than just a son wanting to follow in his father's footsteps. The experience added a personal passion to it; I saw the patient's perspective.

How did you choose trauma surgery as a specialty?

I did my general surgical residency at Los Angeles County/Southern California Medical Center Trauma Center from 1983–1987 and had a rich experience in trauma surgery. I grew accustomed to the challenges of rushing a critically injured young person to the operating room and managing through the different phases of post-op recovery. At the completion of my residency, further training in trauma and critical care seemed like the natural next step.

From 1987–1989, I received fellowship training at the Maryland Institute for Emergency Medical Services Systems in

"The most satisfying part of being a doctor is saving lives. In trauma surgery, you can be faced with a life-threatening injury and three hours later you may have saved a life."

Baltimore. I received my certification in General Surgery in 1988, with Added Qualifications in Critical Care in 1990.

I enjoy teaching, too, and trauma surgery offers the opportunity to teach as I supervise surgical residents and medical students through their surgical rotation.

How did you end up in your present position as head of Trauma Surgery at Hopkins?

I was working as a trauma surgeon at Los Angeles County Hospital when I was recruited by Dr. John Cameron, Chairman of Surgery and Surgeon-in-Chief at Hopkins. Hopkins was pursuing Level-1 certification, and they were looking for someone with a background in trauma surgery who also had experience in clinical research.

What kind of injuries do you treat at the Trauma Center?

Virtually any injury that can befall a human being. About two-thirds of our patients have experienced blunt trauma: auto crashes, falls, assaults. One-third have penetrating trauma: gunshots and stab wounds.

I'm wearing two beepers right now, and one is for trauma only. If that goes off, I run down to the ER; I don't even make phone contact first. Many times, when a patient arrives, we are already waiting for him.

Tell us about your innovation at Hopkins, the Trauma Admitting Unit.

It's a two-bed unit for the admission/observation of trauma patients, whose need for an operation is not clear. Sometimes we admit a patient and ten minutes later we're operating on his abdomen or chest, but most patients don't rise to that level of activity. When we operate on gunshot wound patients, for example, it is to repair damaged structures rather than to retrieve bullets; sometimes we need to observe patients for a while, see how they're doing, before we decide whether or not they need surgery.

Rather than leaving those patients we need to observe down in the ER, and possibly causing a bottle-neck that could close the unit, the TAU allows us to monitor them closely over several hours. It benefits both the patient and the department because triage [evaluating and prioritizing patients for treatment] is done much more quickly, and we get these patients out of the ER while still keeping a close eye on them.

What are your other duties as head of Trauma Surgery?

Administrative duties are a large part of it. Ensuring clinical follow-up and doing the paperwork necessary to keep a Level-1 Center operational. Collaborating, writing, and reviewing papers, making daily rounds. Preparing for conferences. I'm giving a talk for students and residents today at 4:00 p.m., and I've got to gather my slides for that.

Continued on page 28

What is the best part of your job?

The most satisfying part of being a doctor is saving lives. In trauma surgery, you can be faced with a life-threatening injury and three hours later you may have saved a life. It's also satisfying to see a resident through a procedure for the first time. Interaction with my colleagues, discussing papers, writing papers, that's very satisfying, too.

What's the most difficult part of your job?

We see a lot of young people, teenagers, shot through the head, and having to tell a family that a young kid is dead—that's the worst. There's nothing even a close second to that.

What kind of physical demands does a 24-hour rotation put on you?

Trauma is frequently a nocturnal disease. And when the beeper goes off at 3 a.m., you have to rouse yourself or stop what you're doing, and be ready and waiting five minutes later in the ER.

What special personality traits do trauma surgeons need?

Stamina. A work ethic. Decisiveness. Perseverence. Compulsiveness.

Why compulsiveness?

You have to make sure you cover all the bases, all the time. Did you get the T-spine x-ray on that patient? What about the C-spine? Blood count? When was the last time we got a pressure reading? You have to be that thorough with every patient.

How do you handle the demands on your time and still maintain a personal life?

There's a trade-off: availability for predictability. Although we spend many nights in the hospital, we know which nights those are. There is a trauma attending physician in-house 24 hours a day, available to take care of whatever comes. My colleagues in other surgical fields may get called when they are having dinner, because an unstable patient needs them and there's no one else available.

In many ways, trauma surgery is on the front line in the battle against a lot of social ills—gun violence, drug addiction, homelessness. How do you keep from getting discouraged?

You know, we all use a lot of rationalization to get through some of the situations we see: "it won't be me," but black or white, rich or poor, it makes no difference. It could be any of us, and I try to remember that. But I can't think too much about the big picture while I'm working. I have to focus on the task at hand, saving the patient. I'm also good at leaving work at work; I don't take it home with me. I have a three-year-old at home who demands my full-time attention. Sharing my experiences with my colleagues helps, too.

So being a trauma surgeon is more than just what they show on "ER?"

In shows like *ER*, they compress about a year's worth of action into 60 minutes. I enjoy watching it, though; they've got good technical advisors.

Several years ago, my brother and I were at the Super Bowl, and two actors from the show, George Clooney and Anthony Edwards, were sitting in front of us. My brother tapped them on the shoulder and playfully said,"My brother is a *real* trauma surgeon." We ended up having a nice conversation.

What is the most common pitfall for people who enter medicine?

When I'm interviewing prospective students for medical school, I often hear the same response, "I want to help people," an admirable goal that is easily articulated when you're well-fed and rested. But four or five or six years down the line, when things get tougher and it's the middle of the night, a tired physician can easily forget that people part. A lot of what we see as doctors is the result of lifestyle decisions made by patients, and it is easy to blame the patient. We have to remember we all have that common goal, to help the patient.

When young people think they might be interested in a career in medicine, what do you suggest they do to find out if the field is for them?

I have students shadow me: "come on with me, be on call. It's the best thing I can do, show you what it's really like, and then you decide if it's right for you." I don't think it's fair for someone to have to work hard for years in school, preparing for a medical career, and then find out medicine isn't for him.

To earn the Level-1 rating, Trauma Centers like the one at Hopkins must be involved in community outreach and education. You are also involved in outreach to young people on a personal level. Why is this so important?

We operate on many, many teenage kids, see them through surgery into recovery, and then we send them right back to the same setting. As you see the patterns repeating themselves, you wonder if you're doing the right thing, wonder why we aren't finding out what got them in front of a gun in the first place. If we don't do something more, we become medics in an unwinnable war, patching them up and sending them back for the next injury.

In the late '80s, faced with the advent of crack and rising gun violence, some colleagues of mine and I got together and wrote an editorial, resolving to become involved with violence prevention. As a physician, I have a forum; that's why you're talking to me now. There can be a consensus about a lot of these things, like the lunacy of kids carrying guns, without participating in the strident demonization that occurs in political discussions. As a physician, I try to reach that common ground. That's what my colleagues and I are trying to do—we are trying to put ourselves out of business.

NOSB–continued from page 16

One of the immediate benefits of the competition was that students gained an increased understanding of why things they are familiar with happen the way they do. "For example, anyone who has been to the beach and seen the tides come in or go out has seen bands of algae or seaweed floating in the water. Students learned that this doesn't just happen randomly. These are regular patterns of organisms found in the water which are called 'rocky intertidal zones.' The students could take their own personal experiences and connect them to real phenomena."

Even though the Gilman team didn't win, (the winning team, for the second year in a row, was Lexington High School of Lexington, MA), they'll be back next year. They plan to start studying earlier and in a more organized and broadly-based fashion. A more long-term benefit of their trip to the NOSB was what the students once saw as just a hobby or fun activity is now a possible career choice. But even if a student decides not to pursue an ocean science as a career, he or she can still come away from the NOSB with a new, deeper understanding of how the oceans, and what happens to them, relate to every aspect of our lives.

For more information, contact Sarah Schoedinger at the National Ocean Sciences Bowl; (212) 232-3900 x221; nosb@brook.edu; http://core.ssc.erc.msstate.edu/nosb.html

(The answers to the questions at the beginning of this article are: 1) Cnidaria; 2) Robert Louis Stevenson; 3) the "Shadow Zone"; and 4) 67 degrees 30 minutes W.)

Other Marine Science Competitions

National Envirothon

Christine Foley, Executive Director, P.O. Box 855, League City, TX 77574-0855; (800) 825-5547; christine-foley@nacdnet.org; www.envirothon.org

Teams of five high school students compete at county, state, and national levels. Sponsored by Canon, this contest tests students' knowledge in five subject areas: soils, forestry, wildlife, aquatics, and the year's selected environmental issue. Members of the first-place team each receive a scholarship of $2,500; second-place team members $1,500; and third-place team members, $1,000. Members of teams placing fourth through tenth receive Canon products.

Young Naturalist Awards

American Museum of Natural History, Young Naturalist Awards, c/o Alliance for Young Artists & Writers, Inc., 555 Broadway, 4th floor, New York, NY 10012-3999; (212) 343-6582; www.amnh.org/youngnaturalistawards/

Students in grades 7–12 select one of three projects based on the annual theme and related to biology, earth science, or astronomy. Two students from each grade win a scholarship (ranging from $500 for 7th graders to $2,500 for 12th graders) and a trip to the American Museum of Natural History for an awards celebration.

Entry deadline is in early January.

Solution to Word Wise

More about ... Pelagos

Our common words for the marine world come from Greek (*oceanus*), Latin (*mare*), and Germanic (*see*) roots. But the Greek word for "sea" has barely survived its linguistic voyage. It lives on only in "pelagic," a rather technical term used to refer to the open ocean, and "archipelago." Literally "chief sea," the archipelago of interest to the Greeks was the Aegean, a sea scattered with islands. With time, the focus shifted, and we now use "archipelago" to refer not to the sea but to clusters of islands.

R	O	S	S	■	S	T	E	P	■	F	A	T	S	O
E	R	N	E	■	N	A	T	O	■	A	R	R	O	W
A	C	I	D	■	A	G	A	R	■	B	R	I	N	E
P	A	C	I	F	I	C	■	P	E	L	A	G	O	S
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C	E	T	A	C	E	A	■	M	A	N	A	T	E	E
A	M	I	N	O	■	G	O	A	L	■	P	O	R	T
T	I	D	A	L	■	O	S	H	I	■	I	R	O	N
S	T	E	L	E	■	S	H	I	N	■	N	A	S	A

Coach's Corner–continued from page 35

students must arrange to take the exam at a participating school.

AMC->8

- 40-minute multiple-choice exam.
- Open to junior high school students in grade 8 or below and home-schooled students under 15.
- 2000-2001 test date: Nov 14, 2000.

AMC->10

- 75-minute multiple-choice exam.
- Open to high school students in grade 10 or below and home-schooled students under 17.
- 2000-2001 test date: Feb 13, 2001.

AMC->12

- 75-minute multiple-choice exam.
- Open to any junior or senior high school student and home-schooled students under 19.
- 2000-2001 test date: Feb 13, 2001.

American Invitational Mathematics Exam (AIME)

- 3-hour exam in which each answer is an integer from 0 to 999.
- All students with a score of at least 100 on the AMC->12 or a score in the top 1% on the AMC->10 are invited to take the AIME.
- 2000-2001 test date: Mar 27, 2001.

USA Mathematical Olympiad (USAMO)

- 6-hour essay/proof examination.
- Approximately 180 of the top-scoring AIME participants are invited to take the USAMO. (For more details, see the AMC Web site.)
- 2000-2001 test date: May 1, 2001.

Contact information:

Titu Andreescu, Director, American Mathematics Competitions, University of Nebraska-Lincoln, Lincoln, NE 68588-0658; 402-472-6566, Fax 402-472-6087; titu@amc.unl.edu; www.unl.edu/amc/

Planning Ahead for College

by Linda E. Brody, Ed.D.

Most college freshmen are 17 or 18 years of age and have completed four years of high school before entering college. The majority will have taken honors or AP-level courses in their high schools. Knowing that extracurricular activities affect college admissions, most will have participated in a variety of high school activities.

If you differ considerably from this profile because you are highly accelerated, have been homeschooled, or attend a high school with limited educational resources, you may be nervous about how college admissions officials will view your application. Or, if you hope to apply as a candidate for Early Decision, you may be a bit concerned about having less time to accrue achievements before submitting college applications.

While college admissions officials value a variety of interesting and unique experiences as they seek to put together a new class, they also look for assurance that a prospective student has the background necessary to succeed in college. This article discusses ways to enhance your preparation and, consequently, your chance of acceptance to the college of your choice. The suggestions may be particularly important if the path you have taken through high school has been unusual and might cause admissions officials to question whether you are ready for the challenges you will encounter in college.

College Applicants with Unusual Backgrounds

The overriding goal of admissions officers at highly selective colleges is to admit students who are socially, emotionally, and academically ready for college. They look for students who have taken rigorous course work as preparation for the academic demands of college, and who have the social and emotional maturity needed to succeed. If you fall into one of the following categories, be prepared for college admissions officials to question your level of preparedness.

Accelerated Students. If you are considerably younger than the typical applicant, even if you are graduating from high school, there may be concern about your academic preparation and maturity. If you plan to leave high school without graduating, your application will be scrutinized for a compelling reason as to why you are ready to leave high school early.

Homeschooled Students. If you are homeschooled, the lack of a traditional transcript may make it difficult for admissions officers to interpret your academic credentials. There may also be concern about your ability to interact with peers if you haven't attended classes with other students.

Students Who Attend High Schools with Limited Resources. While college officials understand that some high schools have more educational opportunities than others, there can be concern about whether your preparation is adequate for the challenges that lie ahead if your experiences have been limited compared to others. If you haven't taken rigorous advanced courses, admissions officials may worry about your academic preparation, even if you've earned stellar grades. If your school doesn't offer extracurricular activities, you will be expected to seek opportunities to develop interests and demonstrate leadership outside of school.

Candidates for Early Decision. Since your application will be due in the fall of senior year instead of winter, you will need to have enough experiences by the end of your junior year to make you competitive.

If you fall into one of these categories, or if you are just generally concerned about whether your background and credentials will be competitive with other college applicants, the following suggestions may be helpful.

Take Standardized Tests. Most colleges require some standardized achievement tests such as the SATII, and many college-bound students also take AP tests. If there is any question about your academic preparation for college because you are homeschooled or lack credentials in other ways, take as many additional standardized tests as possible. Good performance will serve as proof of your knowledge base compared to a national sample of students. Note that you can take an AP test even if you haven't officially taken the corresponding AP course.

Seek Advanced Courses. If your school offers advanced courses, take full advantage of them. But don't limit your options to school courses, especially if school offerings are limited. You can demonstrate initiative and build a strong academic record by taking advantage of academic summer programs, distance learning courses, and part-time enrollment in college. If you are homeschooled, these experiences provide assessments of your work compared to other students.

Consider Early Entrance Programs. Colleges are increasingly receptive to the applications of young students who demonstrate preparation comparable to other incoming students. However, if you are leaving high school early and may need more social and emotional support than colleges typically provide, consider early college entrance programs that have been established for such students (see *Imagine*, V.6 No. 2, p. 25).

Challenge Yourself through Activities. Extracurricular activities are important in demonstrating talent outside of the classroom, as well as initiative, leadership potential, and social and emotional maturity. Become involved in activities that you can excel at, whether they are school-based, community-based, or allow

you to pursue an individual talent such as music or poetry.

Participate in Summer Residential Programs. In addition to the opportunities for learning and personal growth that such programs provide, you can demonstrate your readiness to live away from home by living on a college campus while attending a summer program. If you are a young applicant or if something else about your background raises questions about your social and emotional maturity, your experience living away from home may be reassuring to admissions officials.

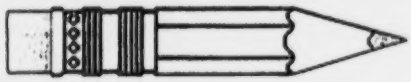
Schedule On-campus Interviews. Although optional for the majority of applicants, on-campus interviews provide an opportunity for you to demonstrate your maturity or talk about your unusual background to a member of the admissions staff. For younger applicants, it may even be required by the college.

Prepare your Application Conscientiously. Your application must communicate that you are well prepared academically, socially and emotionally to be a college student. It should also portray your uniqueness by spotlighting the factors that set you apart as special. List all experiences that accomplish these goals, and choose your essay topic carefully. Select people to write reference letters who know you well and can attest to your superior intellect, advanced content knowledge, social and emotional maturity, and strong work ethic. And, of course, proofread carefully!

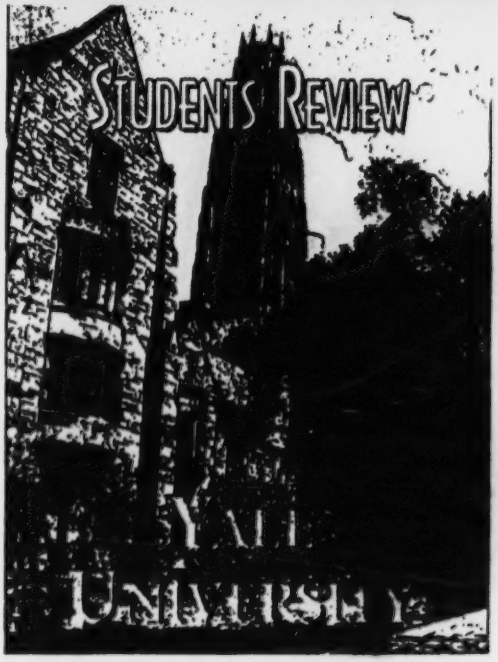
If you purposely seek experiences that enhance your academic and social preparation for college, and present a careful application that accurately portrays all of your strengths, you can approach the admissions process with confidence. Admissions officials will try to determine if you are a good match for the environment they are creating. If you aren't accepted by your first-choice school, it's likely that it wasn't right for you, and you'll go somewhere else where you should ultimately be happier. But the process of preparing for college will have given you a stronger background and sense of self that will help you wherever you go.

Mark Your Calendar...

with these September–November registration deadlines for selected academic competitions. Inquire about competition format, dates, and fees.



DEADLINE:	COMPETITION:
September	**United States Academic Decathlon**—Schools register teams, grades 9–12; state deadlines vary: 10882 Kyle St., Los Alamitos, CA 90720; (562) 626-0092; usad@usad.com; www.usad.org
	U.S.A. Computing Olympiad—Students in grades 9–12 register online for fall, winter, and spring contests: University of Wisconsin–Parkside, Box 2000, Kenosha, WI 53141-2000; (414) 595-2231; piele@cs.uwp.edu; www.uwp.edu/academic/mathematics/usaco/
October	**Future Problem Solving Program**—Schools register teams, grades 4–12; ask about state affiliates: 2028 Regency Rd., Lexington, KY 40503; (800) 256-1499; FPSolve@aol.com; www.fpsp.org
October 6	**Mandelbrot Competition**—Schools register, grades 9–12; request invitation letter by Sept. 15: P.O. Box 380789, Cambridge, MA 02238-0789; (671) 661-3188; info@mandelbrot.org; www.mandelbrot.org
October 6	**Mandelbrot Midlevels Competition**—Schools register, grades 7-8; request invitation letter by Sept. 15: P.O. Box 380789, Cambridge, MA 02238-0789; (671) 661-3188; contact@midlevels.org; www.midlevels.org
October 15	**National Geographic Bee**—Principals register schools, grades 4–8; National Geographic Society, 1145 17th St., NW, Washington, DC 20036-4688; (202) 828-6659; www.nationalgeographic.com/geographybee
October 30	**National German Test**—German teachers register, German II-IV: American Association of Teachers of German, 112 Haddontowne Ct. #104, Cherry Hill, NJ 08034; (609) 795-5553; aatg@bellatlantic.net; www.aatg.org/hsstudentprog/testing.htm
November 1	**AMC -> 8 (formerly AJHSME)**—Schools register, up to grade 8; lower fee for registering before October 15: Dr. Titu Andreescu, American Mathematics Competitions, Department of Mathematics and Statistics, University of Nebraska, P.O. Box 81606, Lincoln, NE 68588-0658; (402) 472-6566, (800) 527-3690; fax (402) 472-6087; titu@amc.unl.edu; www.unl.edu/amc
November 15	**U.S. Senate Youth Program**—Each state nominates two delegates and alternates in grades 11–12 who are elected student leaders: Ask your high school principal, chief state school officer, or office of DoD Dependents Schools.
November 24	**Knowledge Master Open**—Schools enter one team per division (middle, junior high, high school): Academic Hallmarks, Box 998, Durango, CO 81302; (800) 321-9218; kmo@greatauk.com; www.greatauk.com
Other	**National Spelling Bee**—Scripps Howard, Inc.: Students enter only through a sponsoring newspaper; ask your local press if they participate, or find your local sponsor at www.spellingbee.com/particip.htm
	Scholastic Art and Writing Awards—Students in grades 7–12 submit their work in 16 visual arts and 9 writing categories. Regional deadlines vary with some as early as November: 555 Broadway, 4th Floor, New York, NY 10012; (212) 343-6493; a&wgeneralinfo@scholastic.com; www.scholastic.com/artandwriting/



The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 18 students, who major(ed) in American studies (1), archaeological studies (1), classics (1),computer science (1), East Asian studies (1), economics (1), English (1), environmental studies (1), ethnic studies (1), history (3), humanities (1), international studies (1), math (2), molecular biophysics & biochemistry (2), music (1), philosophy (2), political science (1), and psychology (1). (The number of majors exceeds 18 because five students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

The word that was repeatedly used in describing the quality of instruction and the academic resources was "excellent." The faculty generally received high marks for accessibility. Rather than a core curriculum, Yale has a system of distribution requirements. This system, and the range of courses available to fill the requirements, received unanimous praise.

"Yale focuses a lot of attention on its undergraduates, as opposed to some other major research universities. Professors teach almost all the classes (except things like calculus) and tend to be very accessible; in addition to regular office hours, many profs invite students over to their houses or eat with students in the dining halls."

"I never found a professor who refused to meet with students. Some of the more famous professors may seem intimidating, but they are accessible if you can overcome your own feelings of awe."

"The best. The music department has quite a few genius-caliber musicians. My experiences are admittedly different from most, but I count two professors as close personal friends, and two others as peer acquaintances. That's the kind of faculty-student interaction Yale affords."

"There is no set core curriculum, thank goodness. Instead there are distribution requirements, which do not track students into special courses for the uninterested, as cores tend to do. There are many small seminars; students can find people to teach special courses above and beyond the regular 2000+ offerings."

"The course offerings are staggering. There were always many more courses available that interested me than I could take in a semester. And academic resources are incredible; I was amazed at the stuff we had in our libraries."

"I took a special science program for freshman called Perspectives on Science—an awesome program in which faculty members lectured about their research projects every other week. On the off weeks, we had discussion sections. The program culminated in providing funding for students to do research in the summer with members of the Yale faculty."

"I was in a special humanities program for freshmen called Directed Studies—an extremely demanding program that consists of three related seminars (literature, philosophy, and history & politics) taught mostly by full professors. Directed Studies allowed me to have access as a freshman to famous professors—people who helped guide my course selection later on."

"I got an outstanding education. But not everyone does. Attending a research university, students have to make a choice between hiding out in the back of large lecture courses and learning nothing or working hard in a small seminar and learning a great deal. Both options are very possible at Yale."

Social Life

Reviewers praised the Residential College system, which provides a small-group environment and fosters a sense of community, and the vast array of extracurricular and volunteer activities.

"The Residential College system (modeled on Oxford's) is extremely important to the social life. It provides a community-within-the-community that I found reassuring. By breaking down the 5,000 members of the student body into 400-person groups who live together for four years, it creates a smaller school atmosphere within the larger university. It's excellent socially for students who get along best in a small group environment. Because the Residential Colleges are basically assigned randomly before freshman year, each college tends to be a representative mix of the student body."

"The colleges are definitely a plus. They make it easy to meet people (unless you are a slacker/hermit who never goes to class) and prevent cliquishness. I am not an athlete or an artist, yet I have befriended athletes, singers and actors. I've learned so much from getting close to people whose experiences and interests are so different from my own."

"Social life for undergrads is excellent. For a school this size, the campus is relatively small. Yalies take their extracurriculars seriously; no extracurricular commitment is ever casual. This can be a problem, because people aren't really free to dabble in something new. But it also creates the vibrant and accomplished cultural life that distinguishes Yale."

"Clubs offer a great part of life at Yale—I marvel at the sheer number of organizations at Yale and the fact that they are all entirely student run. We handle budgets, logistics, administration, everything. It's the greatest practical education you can get in college: the experience of taking an idea, creating an organization around it, and doing all the grunt work needed to make it succeed. No matter what your interest, there's a group for you, and if not, you can start one easily."

"There are many opportunities for interacting with the New Haven community

through Big Brother/Sister programs, soup kitchens, and other programs, which altogether involve over half the undergraduate student body. I worked at a homeless shelter founded by Yale students and was part of student- and community-led campaigns to open more beds for homeless people in the city."

"Yale has so much going on within it that you don't really need external social opportunities. Yet for those who want more, New Haven has much to offer. It's not the most cosmopolitan city, but it has a good art and theater scene, some beautiful architecture, many different ethnic restaurants, and both hiking and beaches. The best thing about New Haven, though, is the civic spirit and the extent to which New Haven residents really care about the city. I have grown to love New Haven."

What Do You Like Best about Yale?

"The friends I made and the innumerable stimulating conversations I had with people in the dining hall, courtyard, or even crew lagoon. I liked the sense of community and camaraderie that allowed me to learn more about myself and the world around me in a (mostly) painless way."

"The academic freedom afforded by a system of distributional requirements rather than a set of core courses."

"The sense of moral commitment and responsibility so many students feel. It is very moving to see so many students—half of the undergraduate population—regularly engaged in tutoring, service work, and social activism."

"To me, what Yale has to offer above and beyond other Ivy League institutions is its strong arts tradition. The Schools of Art, Drama, Music, and Architecture, the Yale University Art Gallery, and many other things make Yale very rich in the fine arts. We have so many plays every week, so many musical groups, singing groups, and fine painters and sculptors. Not only can I enjoy my classes, but I can enjoy a heightened appreciation for the arts among my peers and see the work they produce. It's like living among future celebrities."

What Do You Like Least about Yale?

"Safety remains an issue in New Haven. With adequate precautions, it's not a big issue; but having to avoid certain places at night was definitely a minus. The libraries, restaurants, and theaters are all in very safe areas."

"Yale's aura of privilege. It is fairly diverse, and it makes an effort to be so. But the students, for all their ethnic diversity, are—or seem to be—quite affluent. The true barrier is class. My friends who come from poor backgrounds definitely have a harder time here. Being around peers who are insanely rich, privileged and well-connected makes kids who have to struggle feel isolated, doubly so if they are minorities."

"The self-satisfaction of most Yale students (although I probably share in it). When I was applying to college, I read in one guidebook that 'Everyone at Yale secretly thinks that everyone else in the world (with the possible exception of Harvard students) really wanted to go to Yale and couldn't get in.' Never did a guidebook print truer words."

Yale University

New Haven, CT 06520
(203) 432-9300

- 4-year private coed university.
- Urban campus in a small city.
- Full-time undergraduate enrollment 1999-2000: 2,667 men; 2,599 women.
- Special features: Yale Repertory Theater, Yale University Art Gallery (the second largest university-based art museum in the nation), Yale Center for British Art, Peabody Museum of Natural History, Beinecke Rare Book Library, cyclotron.

Who Would Be Most Compatible with the Academic and Social Atmosphere at Yale?

"There's no one type of person who would fit in best at Yale. Qualities that are important, though, are open-mindedness, the ability to enjoy challenges, an inquisitive spirit, and a desire to work hard. There are many kinds of people at Yale and many niches to fit into."

"Motivation is the key. I found little overt pressure in the sense of cut-throat academic competition. But I did find a subtle, pervasive pressure: one feels a need to be exceptional at something. It may be academics, it may be extracurriculars, but it has to be something. With so many brilliant, talented, or just plain privileged people around, there are inevitably times when one feels inadequate; and this may be why some people feel oppressed there. But a person with a strong sense of self and an ability to motivate him- or herself can thrive in Yale's environment."

If You Had It to Do Over Again, Would You Go to Yale?

All reviewers enthusiastically said yes.

"Absolutely. I love Yale from the bottom of my heart. The warm and varied social life, amazing extracurricular and academic opportunities, and the respect and attention paid to undergraduates at Yale are too wonderful to miss. I think Yale is probably the best undergraduate experience in the country."

"Yale was my first choice, my only choice, and it remains so. I love the people, both faculty and students, with whom I work and play."

"Definitely. The combination of academics, extracurriculars, and intellectual and social life was, for me, unbeatable. True, many things would be similar at the other schools I looked at when I was a senior in high school. But looking back, I think the little differences really add up—Yale was just a better place for me to be."

"Absolutely. I would give so much for just one more year there."

As you try to find the college or university best suited to you, the views presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different school. At any college, it is important to seek out challenging academic experiences and to create a social life that fits your personal style.

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

THE COACH'S CORNER

The American Mathematics Competitions

by Zuming Feng

Last year, over 700,000 students participated in the American Mathematics Competitions (AMC), a series of mathematics examinations for junior and senior high school students. One goal of the AMC exams is to spur interest in mathematics and to help students develop problem-solving abilities. The other is to identify students with truly exceptional mathematics talent. The AMC->12 is the first of three exams used to select the six students who represent the United States at the International Mathematical Olympiad (IMO), the most prestigious and difficult secondary mathematics examination in the world. The IMO began in 1959, and the United States has participated since 1974.

Levels of Participation

The first tier of exams (the AMC->8, AMC->10, and AMC->12) are multiple-choice tests that allow students to participate in the AMC at a level appropriate for their mathematical training. The AMC->8 is intended for 7th and 8th graders, the AMC->10 for 9th and 10th graders, and the AMC->12 for 11th and 12th graders. However, while the AMC->12, the most difficult of these three exams, is designed for older students, it is open to all middle and high school students. Students who are ready for a challenge and who begin taking the AMC->12 early in middle or high school can have the pleasure of watching their scores increase as their problem-solving abilities improve over time.

The second and third tiers of the AMC exams are "by invitation only." The top scorers on the AMC->12 are invited to take the **American Invitational Mathematics Examination (AIME)**, and the top scorers in the AIME are invited to take the **USA Mathematical Olympiad (USAMO)**. The AIME and USAMO are not multiple-choice exams, and the questions are much more difficult than on the AMC->12. The USA IMO team is chosen on the basis of students' performance on the USAMO.

Preparing for the AMC Exams

The best way to prepare for the AMC exams is to work problems from old exams. Studying old exams is a great way to enrich your mathematical experience and expand your mathematical "tool kit." The AMC web site includes old problems and information on how to obtain many resources, including old tests and solutions.

In the math club I coach, we study only four to six problems in an hour-long meeting, working on problems like those on the AMC->12, AIME, and USAMO exams. Everyone works on two problems for perhaps 10 minutes, during which time students may confer with each other. Then we reconvene, and a student who solved the problem talks us through his or her solution. This requires students to explain their thinking clearly and helps them improve their presentation skills. Often, another student may have begun working on the problem using a technique that was successful in cracking a similar-looking problem, but ran into a dead end. The group may explore why that approach failed for this problem. Examining such "false starts" helps students see how problems that may appear similar are actually quite different. Working many problems helps one cultivate the ability to grasp more quickly what approach to use—and to sense when an approach will not pan out and should be abandoned.

Only certain kinds of problems lend themselves to the multiple-choice format, so only certain kinds of questions appear on the first-tier AMC exams. I want my students to have experience with a broader range of problems, including proofs, so I use problems from the AIME and USAMO as well as ones from the AMC->10 and AMC->12 in math club. Working on harder problems is also clearly useful to students whose performance on the AMC->12 makes them eligible to take the AIME or USAMO.

If you are preparing for the AMC exams on your own, without the benefit of a coach, you can do the same: study problems from a range of old AMC exams. You may be inspired to know that the captain of the 2000 USA IMO team is homeschooled and has not had a math club to help him prepare.

The Math Olympiad Summer Program

Every summer, 24–30 students—the members of the USA IMO team for that year, along with younger students whose USAMO performance suggests that they may be team members in a year or two—receive intensive math training and coaching at the four-week Math Olympiad Summer Program (MOSP). There, students prepare to face the best young mathematicians from around the world. The US mathematics curriculum is weak in several areas where other nations' curricula are strong, and MOSP helps students fill in gaps in their knowledge and hone their problem-solving skills.

The daily schedule is rigorous. The "rookies" (the students who are not on the USA IMO team) spend three to four hours a day in lectures, then work on problem sets for the remainder of the afternoon. Every day, the rookies have a lecture on some area of geometry, a subject that US students are especially weak on compared with students in other countries. Lectures also cover topics in number theory, combinatorics, polynomials, and inequalities. The "veterans" (the USA IMO team and alternates) already have the content knowledge they need; their training

*A math teacher and coach at Phillips Exeter Academy in Exeter, NH, **Dr. Zuming Feng** has been an instructor at MOSP for the past four years.*

Creative Minds Imagine

As a high school freshman, Alexis Kusy wrote the following story in response to this assignment from her geometry class:

Write a legend for the mnemonic device of Sohcahtoa to build understand of trigonometry.

In triangles:

Sine-opposite over hypotenuse

Cosine-adjacent over hypotenuse

Tangent-opposite over adjacent side

Princess Sohcahtoa

by Alexis Kusy

In the land of Trigonometry, King Triangle and Queen Right Angle were going to have a baby girl.

The celebrations were prepared and the whole land was joyous. There was one problem, though: what to name her?

Since she would inherit the throne, her parents wanted her name to sound patriotic. To show her diversity, they decided to name her after different parts of the country. She would be a sign that could unite the country, even the cities on the opposite sides of the Calculus Mountains and the hypothesizers, who always worried.

She would be their partner and coworker, a co-sign, so to speak. They decided to name her after the adjacent village of Angle Bisector, a symmetric town filled with pleasant people, and for the town of Hexagon, a well-rounded village where everyone helped each other. They wanted their daughter to bring enjoyment to the people, so they named her Tangent for the popular vacation spot on the East Coast. There, the separatists from the opposing towns of Skew Lines and Scalene Triangles and the orderly families from the adjacent lands of Rhombus, Rectangle, and Isosceles enjoyed themselves during the summer.

But they couldn't call the princess Sign-Opposite-Cities-Hypothesizers-Coworker-Angle Bisector-Hexagon-Tangent-Skew Lines-Rhombus, Rectangle & Isosceles! No one would be able to remember her name!

The queen reluctantly abbreviated her name: S for sine (she couldn't spell), O for opposite cities, H for hypothesizers, C for cosine, A for the town of Angle Bisector, H for the town of Hexagon, T for Tangent, O for the opposite city of Skew Line, and A for the adjacent lands of Rhombus, Rectangle, and Isosceles.

Everyone in the country loved the baby's name: Princess Sohcahtoa! When she grew up, she was a great ruler who united the country, founded the territory of Geometry, invented proofs, and brought the land of Trigonometry into its golden age.

Alexis Kusy is a sophomore at the Academy of the Holy Angels in Demarest, NJ. She loves math, science, and the humanities, and is an accomplished composer, pianist, and violinist. Recently, she won the grand prize on the television show "Where in the World is Carmen San Diego?"

focuses on problem-solving and more problem-solving. As in our math club at Exeter, in most sessions, students all work the same problems, then compare notes about the approaches they used. By sharing ideas and strategies with one another (something teammates cannot do in the IMO itself), students help each other become more flexible and creative problem-solvers.

The International Math Olympiad

After all their preparations, six exceptionally talented high school students represent the US at the IMO, a rigorous, two-day competition with problems that would challenge most professional mathematicians. The test is a two-day reprise of the USAMO format: each day, contestants have six hours to solve six very difficult essay/proof questions. Success on the IMO requires not only knowledge but also exceptional mathematical creativity and inventiveness. As an example, here is a problem from the 1986 Chinese Math Olympiad:

> *Determine, with justification, if it is possible to arrange 1,1,2,2,3,3, ..., 1986,1986 in a row such that there is one number between the two 1s, two numbers between the two 2s, three numbers between the two 3s, ..., 1986 numbers between the two 1986s. (For example, both 1,1,2,2,3,3 and 1,1,2,2,3,3,4,4 can be arranged into respective desired formats: 312132 and 41312432.)*

This year, the IMO was held in Seoul, South Korea on July 12-25, 2000. The US team placed third overall, behind China and Russia. Three team members earned gold medals (Reid Barton, George Lee, Jr., and Oaz Nir) and the others earned silver medals (Ricky Liu, Po-Ru Loh, and Paul Valiant).

In 2001, the IMO will be held in the United States, at George Mason University, just outside Washington, D.C. Perhaps you'll be there!

AMC Test Formats and Eligibility

All questions can be solved with pre-calculus methods. AMC exams are administered by local schools, which must pre-register in order to participate. Home-schooled

Continued on page 29

Knossos Game

by Tim Boester

Sixteen castaways. Marooned on a tropical island. Forced to send one fellow member of their community home every few days. Who will be the last to endure?

We caught up with some of the eight men (Clay, Preston, Paul, Russel, Chuck, Bill, Howard, & Franklin) and eight women (Tiffany, Pearl, Emory, Chase, Madison, Eutaw, Holliday, & Mary) who were stranded. Although they would not tell us who the winner was, they agreed to give us a few clues. Unfortunately, they secretly agreed that, while the first five voted off the island would tell the truth, the middle six voted off would tell one true statement and one false statement each, and the last five removed would lie all the time. Is it possible, from their cryptic clues, to determine who was the last to remain?

Paul:
I was kicked off after Bill.
I was kicked off before Russel.

Chase:
I was kicked out after Mary.
I was not one of the last five to get kicked off the island.

Eutaw:
Howard was kicked off before Paul.
I was kicked off just before Bill.

Russel:
Luckily, I was not one of the first five kicked out.
Tiffany was one of the last five kicked out.

Howard:
I was kicked off after Chase.
Clay was one of the last five to be kicked off.

Chuck:
Holliday was kicked off after Russel.
I was kicked off after Emory.

Tiffany:
Holliday was kicked off before Paul.
Emory was kicked off before Eutaw.

Preston:
Paul was kicked off the island in the middle six.
Tiffany was kicked off before Paul.

Holliday:
I was one of the last five left.
Mary was one of the first five kicked off.

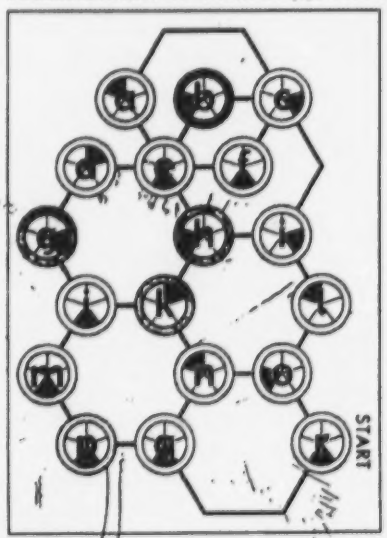
Madison:
I was not one of the middle six to be kicked out.
I was kicked out just before Chase and just after Franklin.

Mary:
I was kicked off the island just after Preston.
Pearl was kicked off before Chuck.

Clay:
I was kicked off just before Madison.
I was kicked off after Russel.

Emory:
Howard was kicked off after Holliday.
I was kicked off after Bill.

Solution to Knossos Game in our May/June issue



solution:
r-o-l-l-h-k-j-m-p-q-n-q-p-m
-j-g-d-e-a-c-b-e-f-c-l

*A graduate student in educational psychology at the University of Wisconsin, **Tim Boester** now has additional puzzles on his home page: homepage.mac.com/boester*

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ImaGiNe

Published by the Johns Hopkins University Center for Talented Youth

Opportunities and Resources for Academic [illegible] Youth

Focus on
Anth[illegible]
Arts

My Passport in Time

Interview with Cynthia McFadden

Students Review Georgia Tech

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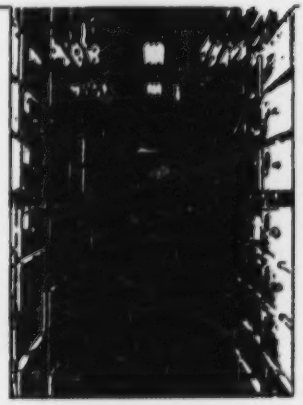

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ImaGiNe...

*Opportunities and Resources for Academically Talented Youth**

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Editor • Melissa E. Hartman
Assistant Editor • Michelle Burkhart
Contributing Writer • Laura Orem
SET Director • Linda E. Brody, Ed.D.
Research Associate • Carol C. Blackburn, Ph.D.
Editorial Assistant • Vicki Moore
Designer • Delta Graphics & Communications

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Address subscription inquiries to:
Imagine
P.O. Box 3073
Langhorne, PA 19047
(215) 826-0707 • fax: (215) 788-6887

Address editorial correspondence to:
Melissa E. Hartman
SET/CTY
The Johns Hopkins University
3400 North Charles Street
Baltimore, Maryland 21218
(410) 516-0309 • fax: (410) 516-0108
email: mhartman@jhu.edu

Web site: www.jhu.edu/gifted/imagine

Cover Photo: Mummy of woman with her head turned slightly toward her husband, Valley of the Mummies, Bahariya, Egypt.
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Culture Shock...

That's what you would probably feel if you woke up tomorrow in a Maasai village. You'd have a hard time understanding certain customs; you'd probably decline the honor of slaughtering the goat for the evening meal. And you'd probably experience culture shock if you could go back in time—millennia, centuries, or even just a few decades—to live among your ancestors. You might think to yourself, *These people may be my relatives, but they're nothing like me!*

Both of these experiences illustrate a key concern of the field of anthropology: the similarities and differences among groups of people. The commonalities help define what it is to be human; the differences show the diverse ways our humanity can be expressed. So the discoveries anthropologists make—whether about people who lived long ago or who live half a world away—tell us something about ourselves.

Anthropology is fascinating not only because it is about us, but also because it allows such varied approaches to studying people. The field is divided into four areas—cultural anthropology, physical anthropology, linguistics, and archaeology—that attract and challenge people with interests as varied as biology and art history. So whether your talents lie in computers or math or language, there's a place in this interdisciplinary field for you.

In this issue of *Imagine*, you'll hear from people who were drawn to anthropology and archaeology for different reasons. College sophomore Sohini Ramachandran started with a strong interest in math, while Dr. Ryan Williams was led to archaeology by interests in both history and technology. Students Alex Solomon, Adam Roux, Jamie Maglietta, and Luke Brandy took to the field in summer programs. And Jane Sanford got started during an internship in the Physical Anthropology department at the Smithsonian Museum of Natural History.

Whether your talents lie in computers or math or language, there's a place in this interdisciplinary field for you.

All of these writers learned something about anthropology and about themselves. Their experiences offer a glimpse into not only the world of anthropology, but also the many ways you can explore it now.

Visit our Web site at www.jhu.edu/gifted/imagine

Anthropology

Putting Everything in Context

by Laura Zimmer-Tamakoshi

As a child and young adult, I was an avid reader of tales of adventure and fieldwork in foreign lands and cultures. Some of what I read was written by anthropologists and archaeologists like Margaret Mead and V. Gordon Childe. But it wasn't until I took my first college anthropology course that I met real anthropologists and realized what a practical and fascinating field anthropology is.

Soon I spent my weekends helping out at an archaeological dig into Pennsylvania's colonial past and attending monthly meetings of the Philadelphia Anthropological Society. Eventually, I began studies that would take me halfway around the world, to the western Pacific.

In the Field

Anthropology is based on a commitment to long-term participant observation, a holistic perspective, and a belief that much of human behavior is best understood in specific social and cultural contexts. That is why much anthropological research takes place in the field.

Most first fieldwork experiences take place at the end of graduate study and involve a year or more spent living within the research population. My first fieldwork, in 1982 and 1983, took place in the Papua New Guinea highlands, where I lived for a year in a village among the Gende people. There, I learned about the economics underlying practices that at first seemed strange to me, such as polygyny (the marriage of one man to two or more wives at the same time) and gambling, which was considered a legitimate form of work for persons who were receiving only little or no cash from relatives working in town.

Like many anthropologists, I have returned to the field many times in order to keep up with changing customs and to develop ties with the local people. From 1986 through 1989, I taught at the University of Papua New Guinea, which gave me many opportunities to return to the Gende and also to expand my interests to urban research and economic development throughout Papua New Guinea. More recent field trips have allowed me to follow up on both the beginnings of a massive nickel/chromite mine that lies within the Gende's territory and my best Gende friend's tourism business.

On the Practical Side

Many of today's anthropologists focus on a range of practical questions, including the cultural contexts of addictions and substance abuse (such as crack cocaine use in America); the relationship between adopting western lifestyles and increased incidences of hypertension and other illnesses among people in "developing" countries; and how to create culturally relevant teaching materials for diverse student populations in American schools. In recent years, many anthropologists have been finding work outside academia, working as private consultants or on the payrolls of various corporate, educational, governmental, and international organizations.

My own work has always had practical consequences. In recent years I have been doing the genealogical and landowner studies necessary to determine what families will get compensation for a mining company's intrusion into the Gende's lands. I have also acted as a consultant on issues as diverse as domestic violence and small-scale women's agricultural projects.

Meeting new people and working in some of the most beautiful settings in the world are bonuses of anthropological fieldwork for me. But what is perhaps most exciting is the fact that I am my research instrument; I must call upon my own inner resources to carry out long-term projects, to survive and thrive after whatever initial shocks I may go through. It's tough physically and emotionally, but when I have done it, I am amazed at my own flexibility and stamina. I have made many new friends and expanded my cultural horizons. I have lived an adventure. ■

Laura Zimmer-Tamakoshi earned her B.A. in anthropology from the University of Pennsylvania and her M.A. and Ph.D. in anthropology from Bryn Mawr College. The bulk of her research has been carried out in Papua New Guinea and has focused on development and change, gender, nationalism, and violence against women. Laura has been teaching anthropology at Truman State University since 1991. She is the media review editor for Pacific Studies.

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The Lure of Archaeology

by Ryan Williams

Many archaeologists in my generation were called to the discipline by Indiana Jones, the daring university professor who searches for relics to curate in the *Raiders of the Lost Ark* trilogy, though most will deny any such association. The truth is that the archaeology practiced by Jones is nowhere close to the real thing—real archaeologists are less concerned with objects than with what those objects can tell us about the past. Nevertheless, some of Jones' virtues—his enthusiasm for discovery, his stewardship of ancient relics, and his relentless pursuit of the truth—are prerequisites to the making of a good archaeologist.

My career in archaeology began in 1990 when I enrolled in a class called Culture Origins at Northwestern University. I had transferred from the U.S. Military Academy at West Point with a strong background in math and a profound interest in geography, but I was seeking a discipline with a strong human and historical dimension. I was also very interested in mapping and the defense technologies, such as infrared binoculars, that had been developed for military applications. It wasn't long before I became fascinated with applying satellite, aerial, and ground-based imaging technologies to archaeology. These tools, which give you information about an object without actually coming in contact with it, are collectively referred to as remote sensing.

But because remote sensing is not a standard part of the traditional archaeology curriculum, I had to seek my training in departments of geography and civil engineering at the University of Florida, where I did most of my graduate work. I had found my calling.

Boston University, where I now teach students how to apply technology and quantification to archaeology, was one of the first to incorporate remote sensing into the archaeology curriculum. Now, many other archaeology programs are beginning to realize the potential of remote sensing, and it will play an even more important role in the future. Why? Because archaeological excavation is a destructive process; it involves the removal of the archaeological record from its native context. In addition, excavation is expensive and time consuming. For these reasons, the excavation process must be carefully formulated. Often the only way to adequately plan an excavation is to have a preliminary idea of what you expect to find and where. Remote sensing is the ideal tool for this purpose, and it has been used successfully in the identification of ancient structures, such as those detailed in North America by archaeologist Ken Kvamme, and the mapping of the sunken Civil War blockade runner *Ivanhoe*. My most recent work with geophysical techniques has taken place at Tiwanaku, Bolivia, where we are trying to map out the limits of this buried city and identify the locations of archaeological monuments and tombs.

If this kind of work intrigues you, know that becoming a professional archaeologist is a long and difficult road that requires patience and discipline. To pursue a career as an archaeologist, you should attend a college that has at least one archaeologist on the faculty (usually in an anthropology department). As an undergraduate, make sure you get practical experience on a dig by participating in an archaeological field school. Then you will be well prepared to decide if you want to pursue advanced graduate studies in the field.

Be forewarned that professorships in archaeology are scarce. Around 100 archaeologists get their doctoral degrees each year, and there are perhaps 10 professorships that become available in the U.S. each year to accommodate them. But other opportunities, such as working as a contract archaeologist for government or business entities, are available; and archaeology provides an excellent background for many other professions, including law and journalism, as well.

Archaeology is a rewarding field that can accommodate interests from ancient art to the application of advanced imaging technology. It's a journey that can take you around the world and into the ancient past. It's a point of departure from which anything is possible. ■

Ryan Williams is Assistant Professor of Archaeology at Boston University and director of the Cerro Baul Archaeological Expedition to Peru. He is interested in the formation, development, and collapse of ancient empires and specializes in the application of geographic information systems and remote sensing techniques in Andean South America. He also enjoys mountaineering, travel, and museums, all of which he undertakes with his wife and three children.

A program of the USDA Forest Service, Passport in Time allows the general public to work with archaeologists and historians on projects ranging from archaeological excavation to historic building restoration. No experience is required, and volunteers are encouraged to explore a variety of projects, receiving a "passport" to fill with stamps documenting their journeys with PIT.

For the past two summers, Alexander Solomon has volunteered at Island Mountain in northeastern Nevada, where Forest Service archaeologists and volunteers worked to excavate a 19th-century Chinese mining site. This dig will be held again through PIT in summer 2001.

MY PASSPORT IN TIME

by Alexander Solomon

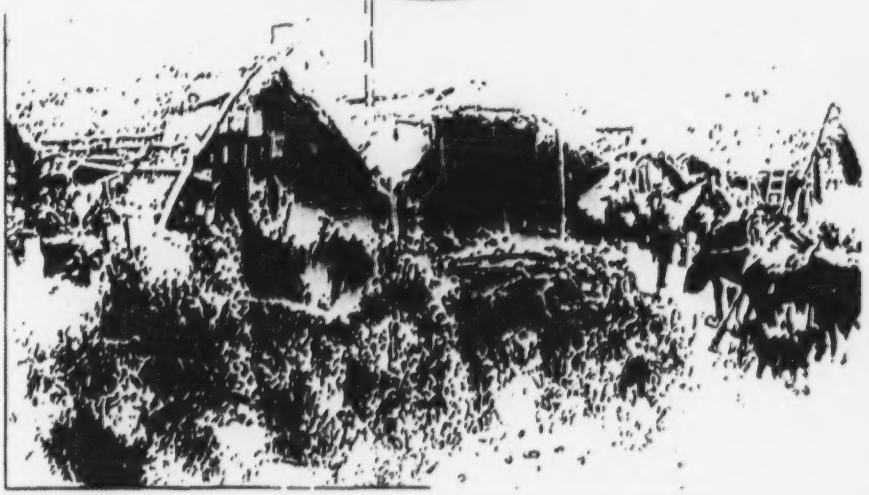
As soon as I arrived in the large van full of other enthusiastic would-be archaeologists, I felt somewhat disappointed. Not much was visible at this remote, lonely, wind-swept spot, located in northeastern Nevada near the Idaho border. We had traveled for several miles over an unpaved, washboard road punctuated with so many ruts and potholes that our stomachs now seemed to be permanently lodged in our throats."This is it. Everyone out!" the driver shouted as he brought the van to an abrupt stop.

So this was it: Island Mountain, the place where we would spend the next week excavating what we had been told was an important archaeological site: a 19th-century Chinese mining camp. Most of us were Chinese Americans who had traveled many hundreds of miles with the intention of uncovering something about our heritage. We gathered around the project leaders: Fred, the Forest Service archaeologist, and Melissa, the University of Nevada grad student who would direct the dig with Bruce, her assistant. With little formality, we were given a crash course on archaeological techniques.

Now It Gets Personal

Before beginning our work, we all walked around the entire site. Although the camp had been occupied from 1873 to 1918, on first inspection it appeared that not much remained. But those of us with keener eyesight began to spot pieces of Chinese ceramics lying on the surface next to several of the pits. This was exciting! We could not wait to find out what archaeological treasures lay beneath the surface of the pits.

Many pits were already staked out and numbered. Each pit was believed to be the approximate site of a building that once had stood in that location. We were shown copies of photographs taken in 1903 that clearly showed the location and appearance of the buildings. One photograph showed Henley, a Chinese miner who had been the photographer's guide, standing behind some mining equipment. Another photograph showed an old Chinese man next to a ramada, in front of a building that was believed to have been a store. This merchant, known as China Lem, had



supplied the camp and surrounding communities with most necessities. He had posed holding a long-stemmed Chinese pipe that gave him a dignified bearing. He was a thin man with a long stringy beard that make him look like one of the Chinese immortals.

Suddenly, our work had new meaning. Here, in these photographs, was a view of the buildings as they once stood, and even pictures of residents of the camp. It was like looking through a window back into time. These images provided a personal connection with the site. We felt inspired, even obligated, to do our part to unearth and preserve whatever remained.

Uncovering Secrets

I began my archaeology career as a "lab rat." This was the nickname of those who worked in our field laboratory. Confined within a netted enclosure, I felt far removed from what I thought was the place of real action: the pits. For several days, people brought me material that seemed like scraps of junk. Under the guidance of two experienced archaeologists, I learned to neatly label plastic and paper bags and carefully catalog and store what had been unearthed from the different locations. But instead of archaeological treasures, I saw only pieces of glass, metal, and pottery. Then, it struck me: only in the lab could you see things recovered from *all* of the locations being excavated.

After a few days in the lab, I was promoted—or demoted?—to the excavation team affectionately called the "Mud People." This was an accurate name, because we were working in a dump situated adjacent to what was now a small stream. However, this work was very satisfying, because we kept uncovering old bottles, some of which were nearly complete. Some people even began to call this site the "Bottle Pit."

A few days later, my dream came true. At last, I was assigned to a pit. Not just any pit, but the one I was convinced would give up its secrets, if only I gave it the attention it deserved. Because the main pits were on a hillside, those assigned to work here were called "hillbillies." At last, I, too, was a hillbilly. However, my initial enthusiasm was dampened when I realized that working in a pit was slow, tedious work. We were not allowed to work too quickly, since this might destroy important features or artifacts. I learned to wield a pick and shovel and how to use a small trowel. The excitement began when we started to unearth things that actually could be identified: a piece of an opium lamp, the edge of a ceramic container for storing pickled vegetables, and part of a glazed Chinese liquor jar. The entire crew was thrilled and very proud.

Back at Base Camp

We stopped work each afternoon and returned to our camp, an old guard station that still had the original buildings from the 1930s. The first order of business was to get clean. We learned to take "solar showers," which involved standing in a makeshift shower enclosure under a plastic bag of water that had been left out in the sun. A narrow tube with a small plastic showerhead, resembling the spout of a watering can, protruded from the bottom of the water bag. If one was patient and methodical, it was possible to soap up and rinse off before running out of water.

Each evening, we gathered in the dining hall—under electric lighting provided by an old diesel generator—for excellent meals, stimulating talks, and a lot of good fun. In addition to the western meals prepared by our cook, Charlotte, we also enjoyed traditional Chinese meals prepared by Max, who was an expert on traditional Chinese food preparation. Max reconstructed the types of meals the Chinese miners probably prepared while at Island Mountain. She also educated us about the cultural significance of Chinese storage containers, foodstuffs, herbs, and beverages. We could now recognize dried Chinese foodstuffs and containers if we uncovered them in a trench!

On several evenings, other experts who were part of our group gave informal talks. We learned about the history of the Island Mountain area and about the lives of Chinese miners from both Fred and from Sue, a University of Nevada history professor. Priscilla, a material-culture specialist from the University of Idaho, gave a talk illustrated by a collection of Chinese artifacts recovered from other sites. We were able to physically examine the types of things we might uncover, which proved very valuable when we returned to the site.

A Connection with the Past

The excavation continued to produce a flow of artifacts, including more bottles, pieces of Chinese ceramics, and a portion of the blade of an old shovel. But before we knew it, it was time to pack up to leave. We had not finished; only the surface had been scratched. However, we still felt satisfied that we had accomplished something worthwhile. We had helped to preserve some of the remains of this old Chinese mining camp and had gained some insight into the lives of these early-19th-century Chinese pioneers.

As we piled into the van, this time to leave the old guard station that had been our home for a week, most of us were hoping to have the opportunity to return to Island Mountain. After all, there was much left to do at the site. The doors to the van closed, and we headed toward Elko, the town that lay 70 miles to the south.

During that drive, many thoughts filled my head. I could not help but feel lucky that I had experienced firsthand what it was like to be part of an archaeological dig. I had learned so much about the history, the lives, even the food, of the Chinese miners who once had lived and worked at Island Mountain. I felt a connection with these early pioneers. I had discovered a bit of my heritage.

Alexander Solomon, 13, is an 8th grader at The Meadows Middle School in Las Vegas, NV, where he is a member of the Junior National Honor Society, the MATHCOUNTS team, and the band. Alex enjoys playing video games, roller blading, biking, swimming, reading, and hiking. He hopes to be a psychiatrist or a writer in the future.

To receive the PIT Traveler, *the newsletter from which this article was adapted, or for more information about archaeology opportunities available through Passport in Time, contact PIT Clearinghouse, P.O. Box 31315, Tucson, AZ 85751-1315; (800) 281-9176; pit@sricrm.com*

Opposite page, top: Lem, owner of Hong Lee Store, Island Mountain. C.A. Laing Collection, courtesy of Northeastern Nevada Museum. Bottom: Island Mountain, Elko County, NV, 1903. Photograph by Hilda Matthey. Inset, in circle: Henley, Chinese miner, 1903. Photograph by Hilda Matthey, courtesy of Northeastern Nevada Museum.

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CTY ARCHAEOLOGY

by Adam Roux

There's only one way to say it: Archaeology is the best course I have ever taken at CTY or anywhere else. Each week the world of archaeology became less mysterious and more fascinating. I came away with not only a new way of seeing the history of mankind, but also a broader perspective of the world around me.

Archaeology filled in those gaps in my knowledge of history that I had no idea were missing. As I knew it, the Americas were settled by humans crossing the Bering Land Bridge and then colonized by people from the Old World. Both my instructor, Dixie Henry, and her assistant, Julie Jaekle, specialized in fields of American archaeology, and they showed the class that there was documented history to the Americas, too. This revelation was like finding out I had read a book that only had the even-numbered chapters. Through the lectures and field trips, my instructors brought the cultures and lifestyles of Native American peoples' long-overlooked existences to life.

The field trips allowed a deeper insight into the subject matter. First we went to the New York State Museum in Albany, which helped us understand the lifestyle of the Iroquois people who had lived in the area. Concepts and objects, such as longhouses and farming techniques, which we had before only heard about from Dixie, now took on a physical form. The second week we traveled to a small, private art museum with a large collection of Native American artifacts, some of which we had special permission to view. At this museum, artifacts were presented in a creepy way: they were displayed out of context, without a connection to lives of the peoples they represented. One exhibit struck me as particularly disorienting. In one room, otherwise benign masks were lit so that they appeared fearsome and demon-like. With artifacts presented as mere art, it was hard to remember that to so many cultures they were much more.

The last trip was by far the best. We traveled to two working archaeological sites on Lake George, where, after a brief tour, we were allowed to help the crews. We carefully sifted through the buckets of dirt that the workers had extracted from the pit, looking for something of interest. My favorite moment from this course happened at the site where I was working. The archaeologists were excavating a barracks from the French and Indian War and had covered most of their pits with tarps. When the tarps were pulled off, an eerie sight emerged: the foundation of a building that had remained under the soil for centuries. It was just a line of rocks and mortar, but the fact that it had survived so long made it powerful enough to make me take a step back.

The class also featured activities and projects that gave us an even greater understanding of what we were studying. We attempted to chip and carve our own stone tools, and in the process gained a substantial respect for the skills and craftsmanship of Stone Age cultures. Another time we experimented with clay to try to re-create how antique cultures made pottery, which again proved challenging and humbling. We also researched an area of archaeology that interested us and presented our results to the class. My project centered on Kennewick Man, a skeleton found in Washington State, and the battle over who his descendants are and whether he should be studied or reburied.

Taking this course awakened an interest I had no idea existed and gave me a desire to learn more about archaeology. Every time I find an article in the paper or *National Geographic* about the pyramids of Teotihuacan or Roman mercenaries in China, I can't help but read it. I've never taken a class that gave me so much in such a short time.

A junior at The Bromfield School in Harvard, MA, Adam Roux is president of the Speech and Debate Team and a member of the Academic Bowl Team. He enjoys baseball, sailing, and playing the violin. Adam is working toward hiking all 48 of the 4,000+ foot summits in New England's White Mountains.

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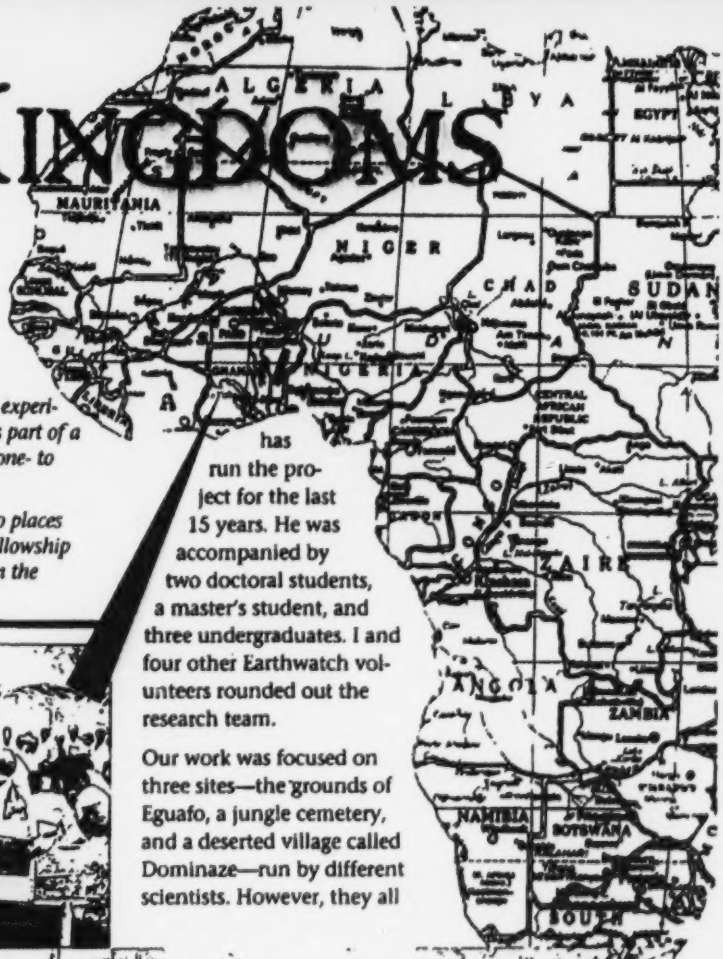
Ghana's Kingdoms of Gold



by Jamie Lynn Maglietta

Earthwatch Institute provides volunteers age 16 and older the unique experience of working on fascinating cultural and environmental projects as part of a real research team. Participants pay a portion of the expenses to join one- to three-week expeditions that take place all over the globe.

Each year, through a competitive application process, Earthwatch also places 40 to 60 high school students in expeditions as part of the Student Fellowship program. Last summer, Jamie Lynn Maglietta's fellowship took her on the adventure of a lifetime—on an archaeological expedition in Ghana.

I love experiencing things for the first time. That is why I love to travel. I hope one day to travel the world.

When I wrote those words on my application for an Earthwatch Student Fellowship, I had traveled only within North America. That's why I was thrilled to learn that I was assigned to an archaeological project in Africa. This was a dream come true: Not only would I be traveling overseas, but I would also be pursuing a longtime interest in archaeology, and this would be my chance to work with real archaeologists.

I arrived in Ghana on July 5. The airport was crowded and unorganized—I had to search through piles for my luggage—but the entrance into another world was thrilling: guards lined the walkway, people tried to carry my bags, and hoards of locals carried signs, held cans for donations, screamed, and tried to touch all who walked near. I knew I was in for an adventure.

Uncovering Fante Culture

Ghana lies on the Gold Coast, so-named by the Europeans who set up trade there because the land was rich with minerals, crops, and, most importantly, gold. They accessed these riches through trade with the local Fante-speaking people, whose culture was then already centuries old. The impact of the gold trade, and eventually the slave trade, on the Fante cultures was significant.

The Earthwatch expedition took place in what was once the center of trade in Ghana, the village of Eguafo in Elmina. Chris DeCorse, a professor at Syracuse University, has run the project for the last 15 years. He was accompanied by two doctoral students, a master's student, and three undergraduates. I and four other Earthwatch volunteers rounded out the research team.

Our work was focused on three sites—the grounds of Eguafo, a jungle cemetery, and a deserted village called Dominaze—run by different scientists. However, they all worked together to accomplish the ultimate goal of uncovering the evolution of Fante culture, both before and after the European influence. I spent most of my time in the cemetery and in the village and learned a lot in both places.

Learning by Digging

The first day we learned how to create square meter units with a line level and metric tape, dig in 10-centimeter levels, graph, and

Continued on page 29

Counterclockwise from top: Jamie sifts for artifacts as local schoolchildren look on; getting to know the Eguafo residents; a recently deserted home in the village of Dominaze, where foundations of older homes were unearthed.

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More Than Artifacts:

What I Discovered at the Center for American Archeology

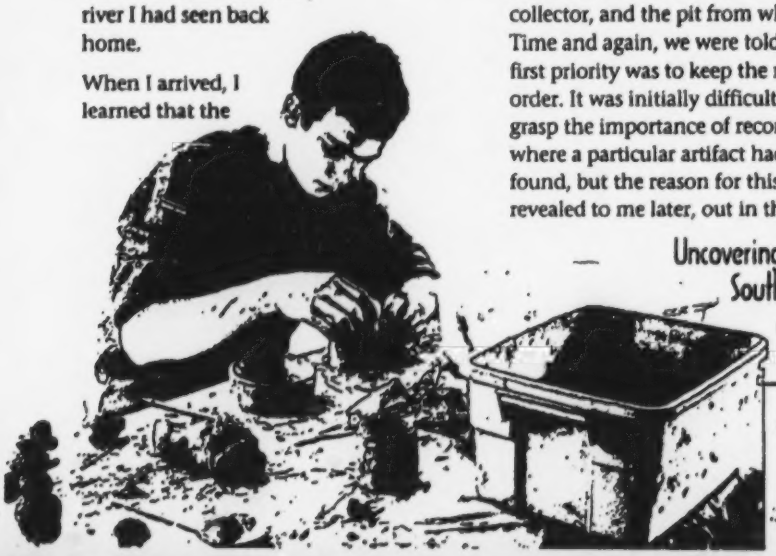
by Luke Brandy

I learned about the Center for American Archeology on the Internet. The two-week archeology program seemed like a unique and interesting way to take my senior project, a graduation requirement of my high school, beyond the typical research paper. So last August, I boarded a Greyhound bus in Oregon and headed east to a tiny town called Kampsville in southwestern Illinois.

I was more than ready to set out on my own, not knowing that my journey would last three grueling days and nights aboard a cramped and crowded bus. By the time I disembarked in Illinois, I would've been glad never to have seen another bus again in my life. It took about an hour to drive by car from the bus station to Kampsville, during which time I became acquainted with the college students who would be the instructors at CAA. Throughout the drive I caught glimpses of the Mississippi River. Like an immensely monstrous puddle, elongated and licking both horizons, the Mississippi was far different from any river I had seen back home.

When I arrived, I learned that the Archeology Center had been founded by Steward Strever in 1974. Originally planning to study the Hopewell and mound-building cultures of the eastern woodlands, he shifted his focus when he learned that the annual plowing by local farmers yielded tools and other evidence of ancient life. In the late 70s, excavations began at the Koster site, which was eventually excavated to a depth of 35 feet. Many independent civilizations were unearthed, and still more were waiting deeper down. Unfortunately, in the 1980s, Illinois state law required the excavation pits to be filled for safety reasons.

The site on which I would be digging, Koster South, was within view of the old Koster Site. When rain prevented us from digging the first day, we went to the lab to learn how to wash artifacts. I worked patiently, employing a colander and a toothbrush to remove centuries of soil from bits of bone, flakes of chert, and pottery sherds collected by previous groups. Each bag of artifacts was clearly marked with the date of collection, the collector, and the pit from which it came. Time and again, we were told that our first priority was to keep the numbers in order. It was initially difficult for me to grasp the importance of recording exactly where a particular artifact had been found, but the reason for this would be revealed to me later, out in the field.



Uncovering Koster South

Our first day in the field began with a trip in the aged, suffering van to the outskirts of town for breakfast. Then, after crossing the Illinois River by ferry, we followed a meandering road that cut through the maze of rural farmland to a gravel driveway.

My first thought was, *This is it?* It could not have been located in a more obscure place. As the dust cloud behind the van settled, I could see a farmhouse, a barn, and decaying tractors laying in rusting heaps on the lawn. The site, an area about the size of a soccer field, had obviously been planted with corn in previous years but was now uncultivated.

To the dismay of the instructors, several of the tarps intended to protect the delicate pits from the rain had given way, filling some pits with water and mud. Until they dried out, those pits remained inoperable. But the rain gods looked fondly upon us: enough of them had made it through the storm that each team had its own pit.

Immediately, I jumped into the diverse tasks of work in the field. I began to familiarize myself with the array of tools that ranged from shovels and masonry trowels to tiny brushes and toothpicks. My mentor—a seasoned archaeologist named Alicia Ventresca—and I started our work by taking measurements in the four corners of our two-square-meter pit. Then, she taught me the art of carefully peeling away layers of soil while constantly listening for the telltale scrape of metal against a possible artifact. Bucket load by bucket load, we meticulously removed the soil,

Top: After realizing that his work boots were destroying his meticulous work, Luke opted to excavate barefoot; Left: A key component of the CAA experience is "experiential archaeology." Luke creates pottery using ancient Native American techniques from clay he collected on a stream bank.

detailing even the smallest findings, until we had taken our pit down 10 centimeters. Each time we came down a level, we mapped the discoveries on grid paper. Then we wrote a detailed description of the soil condition, coloration, and texture, and took a photo of our pit.

Alicia showed me how to sift with a screen, emphasizing that even the most seemingly insignificant flakes of chert or sherds or pottery were worth bagging and taking back to the lab. She also taught me how to take "float samples": for each level we dug down, we removed three 10-liter unsifted samples. In a process involving rotating oscillators and water, the organic materials in the sample would "float" to the surface. The water would drain through a filter, which would then be studied in the lab. This gave microscopic clues as to what was being eaten or burned by the ancient inhabitants of the area.

The extent to which information can be inferred from even the most minute or trivial artifact amazed me. In the field, nothing can be disregarded or discarded. I was reminded repeatedly not to overlook anything. When mapping a sliver of bone or a chip of a blade, measurements were double- or even triple-checked, then recorded with equal care. Just a few centimeters of miscalculation could imply a difference of centuries.

At periodic intervals, the artifacts we discovered in the field would pass through the necessary procedures in order to be catalogued. They would first be washed by hand, set out in the barn for a day to dry, and then sorted and bagged. We placed artifacts that deserved special attention in manila envelopes, labeled with a colored tag. From bagging, the artifacts would be further divided into specific groups before being weighed, counted, and recorded in the lab.

Discovering by Creating

In addition to field and lab work, I also participated in "experiential archeology," hands-on activities that helped us understand how the artifacts we uncovered came to be. Throughout the two weeks, I learned how to flint nap, weave baskets, and make pottery using similar materials and practices as those used by the earliest Americans. I hadn't realized how much skill is required to make an arrowhead or spear point, but through learning flint napping, I came to appreciate and admire the so-called primitive weapons of the Stone Age.

To learn about the ceramics of the ancient cultures, we started with a stroll to a nearby stream in search of the perfect clay deposit. After discovering a suitable source, I dug my fingers into the gray, silky clay, marveling at its texture. Back at the dorms, we worked and kneaded the clay, removing small pebbles and adding sand to temper the mixture before forming bowls and pots. By mimicking the pottery creation of the early cultures, we were able to better understand, identify, and describe pottery sherds found in the field.

I also spent a lot of time reading historical fiction, actual accounts, and the poetry and folklore of the Native American cultures, which allowed me to develop a deeper understanding of the people I was researching. The vast knowledge I acquired during those two weeks was more far-reaching and encompassing than anything I could've learned in a full year of school. I left with rich memories and a greater understanding of archaeology and what drives people to pursue this career. Most importantly, my time in Kampsville awakened in me a passion for the history of Native American culture. The experience changed my life.

With college looming ever closer, my top priority in choosing a school is one with an expansive Native American research program. I now feel that it is my purpose to preserve what remains of the ancient peoples. I believe that the Great Spirit wishes it so.

Luke Brandy, 18, is a native of Ashland, OR. He is a poet with interests in backpacking, reforestation/ecology, Bonsai, and antique car restoration. In the future, he plans to study Native American culture in the Southwest.

For more information about programs available at the Center for American Archeology: CAA Education Program, Center for American Archeology, P.O. Box 366, Kampsville, IL 62053; (618) 653-4316; CAA@caa-archeology.org; www.caa-archeology.org

Related Summer Programs

The programs featured in this issue and mentioned in the list below give just a hint of opportunities available to students interested in archaeology. Visit *Imagine's* Web site at www.jhu.edu/gifted/imagine/links_82.htm for links to these and other programs.

Crow Canyon Archaeological Center
23390 Road K, Cortez, CO 81321-9909; (800) 422-8975; marketing@crowcanyon.org; www.crowcanyon.org
Crow canyon offers several archaeological activities, including cultural explorations, family programs, and summer programs for teens. Middle school students take a one-week session; high school students may take either the one-week excavation course or the month-long field school.

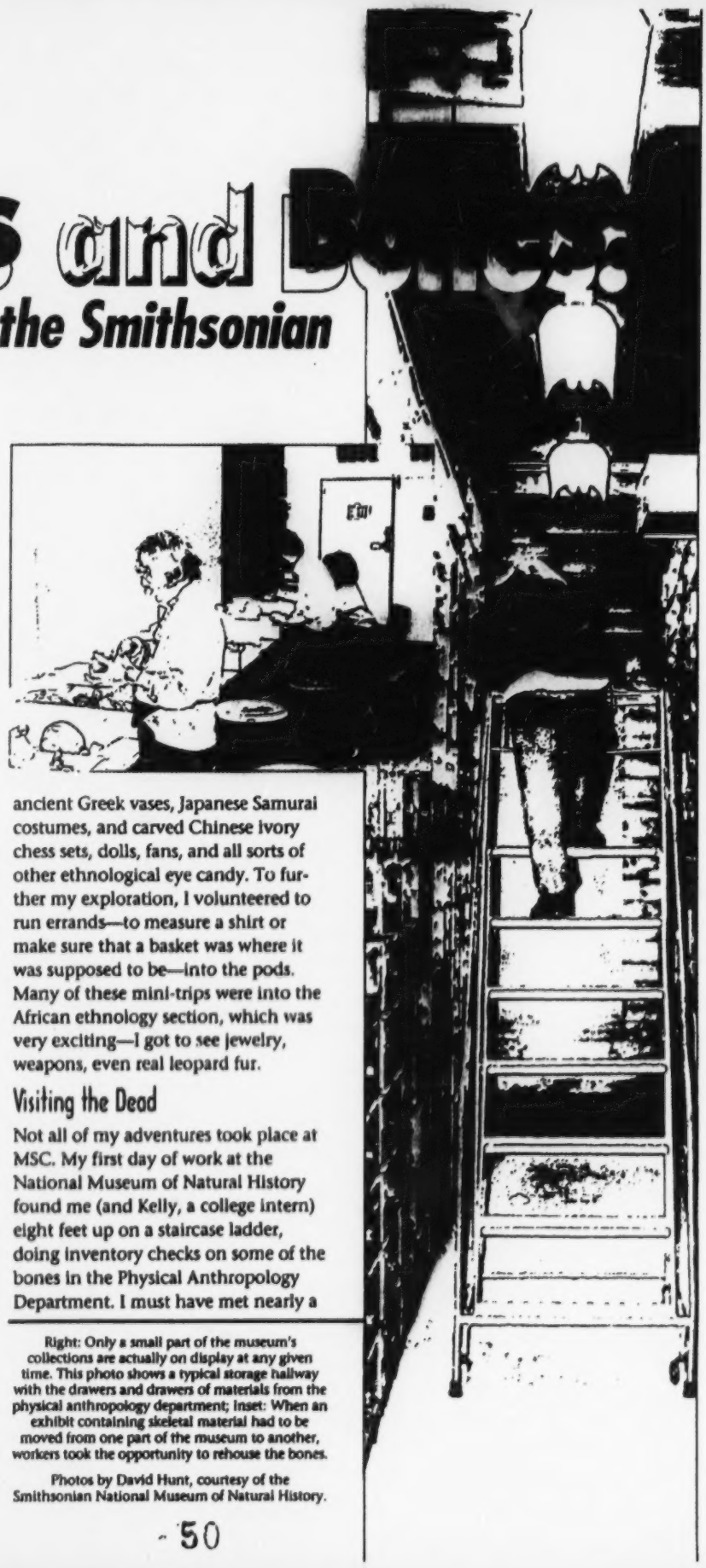
Mississippi Valley Archaeology Center
University of Wisconsin—La Crosse, 1725 State Street, La Crosse, WI 54601; (608) 785-8463; christen.bonn@uwlax.edu; http://perth.uwlax.edu/mvac/
MVAC offers programs for students in grades 1–12. High school students may choose either the week-long field school or the three-day field experience; programs for younger students run two or three days.

Irish Centre for Talented Youth
Dublin City University, Dublin 9, Ireland; 011 353-1-7045634; gilheans@dcu.ie; www.dci.ie/ctyi/index.html
In addition to courses on topics ranging from biotechnology to world geopolitics, CTYI offers two three-week archaeology classes. One of these focuses on Irish archaeology; the other, on civilization in Europe. Both classes include lectures, discussions, and field trips.

UREP Expeditions in Archaeology
University Research Expeditions Program, University of California, One Shields Avenue, Davis, CA 95616; (530) 752-0692; urep@ucdavis.edu; http://urep.ucdavis.edu/arch.html
You don't need experience in archaeology to participate in the six different archaeological expeditions offered by UREP; you'll just need to pay a share of the project costs. Expeditions last for two weeks.

Stones and Bones:
My Summer at the Smithsonian

by Jane Sanford



When school ended last year, I thought I had waited too long to line up anything interesting for the summer. But, thanks to my mom's inquiries, I found out that the Smithsonian still had plenty of demand for volunteers, and I was fortunate enough to schedule two internships. One of my positions was at the Smithsonian Museum Support Center (MSC) in Suitland, Maryland, with Dr. Jim Krakker; the other was in downtown Washington, DC, at the Smithsonian National Museum of Natural History (NMNH) with Dr. David Hunt. In each internship, I had a lot of fun learning what it's like to work in a museum.

From the Lab to the Pods

I started my first day at MSC as I am sure most everyone does, washing sherds. Sherds (pottery shards from archaeological sites) are surprisingly delicate, and washing them is both tedious and time-consuming. I did, however, get to meet everyone in the Anthropology Department, and I also got to see a small part of the African ethnology collection—including shirts, masks, and a little handmade wooden car—that was in the lab at the moment.

Most of my work at MSC involved sorting, counting, and weighing stone flakes, points, and cobble from an archaeological survey in southern Missouri. When I wasn't sorting survey material, I tagged along on tours of the "pods," the storage units for the Smithsonian collections. MSC has 4 pods, each the size of a football field. The Anthro collection is in pod 1, and part of 2. I got an exclusive viewing of ancient Greek vases, Japanese Samurai costumes, and carved Chinese ivory chess sets, dolls, fans, and all sorts of other ethnological eye candy. To further my exploration, I volunteered to run errands—to measure a shirt or make sure that a basket was where it was supposed to be—into the pods. Many of these mini-trips were into the African ethnology section, which was very exciting—I got to see jewelry, weapons, even real leopard fur.

Visiting the Dead

Not all of my adventures took place at MSC. My first day of work at the National Museum of Natural History found me (and Kelly, a college intern) eight feet up on a staircase ladder, doing inventory checks on some of the bones in the Physical Anthropology Department. I must have met nearly a

Right: Only a small part of the museum's collections are actually on display at any given time. This photo shows a typical storage hallway with the drawers and drawers of materials from the physical anthropology department; inset: When an exhibit containing skeletal material had to be moved from one part of the museum to another, workers took the opportunity to rehouse the bones.

Photos by David Hunt, courtesy of the Smithsonian National Museum of Natural History.

thousand different people that day, all of them long dead.

My checks even extended into the attic, where I explored the Mummy Room. I poked through cases full of mummified Egyptian pets (which were anything from cats to baby crocodiles) and young Eskimo children. Two full-sized Egyptian mummies kept me company while I worked. There was even a cheerful-looking bunch of shrunken heads to look at.

After that first, fascinating day, I spent a few solid weeks "housing" skulls. We had to protect skulls collected from an ancient Peruvian graveyard by cutting styrofoam blocks into cushioning for each skull. Kelly and I got so good at this that together we could house 60 skulls in under 20 minutes. When we came across a skull with any signs of disease, deformity, or anything else that looked interesting, we would ask Dr. Hunt about it, and he would respond with a detailed explanation of the disorder that each individual had. Kelly and I learned so much that we developed a competition on who could find the most interesting skull.

Sometimes my work seemed like a puzzle. A few years ago, a collection of some 3,800 immigrants from the early 20th century had been separated, by bone, for testing. We had the interesting game of piecing the collection back into individuals. We sorted the bones by catalog number and returned them to their owners with the same number. We sorted femurs, humeri, and pelvic bones, and managed to turn a small chunk of the collection back into individuals.

I was lucky to have such an interesting experience over the summer. I got to see, touch, and learn about the behind-the-scenes life of a museum. From working in 50-degree labs to dressing up dummies and telling museum ghost stories (the Anthro Department is full of ghosts), I was able to experience firsthand what it is like to be an anthropologist working at the Smithsonian. I hope to return to work at MSC next year, where I will once again be able to see all of my friends, both alive and dead.

Jane Sanford is a 15-year-old sophomore at Woodrow Wilson High School in Washington, DC. Jane's interests include anthropology, history, and zoology.

To learn more about internship opportunities at the Smithsonian, contact the Intern Coordinator, Office of Education, 1163 Arts and Industries Bldg., MRC 402, Washington, DC 20560; (202) 357-2425.

Related Opportunities

Museum volunteerships and internships can provide not only a behind-the-scenes look at how exhibits are acquired, assembled, and stored, but also chances to interact with professional curators and anthropologists. The museums listed below are just a few that have well-established volunteer or intern programs. But almost all museums welcome volunteers, so if you don't see your state represented, call your local museum to ask how you can get involved. Also visit *wwar.com/categories/Museums/Countries/USA/* for links to museums across the country.

American Museum of Natural History
Department of Volunteer Services, Central Park West at 79th Street, New York, NY 10024; (212) 769-5100; www.amnh.org/welcome/getinvolved/volunteering/
Volunteers must be at least 16 years old and able to provide a regular commitment of time, preferably for at least a year.

Carnegie Museum of Natural History
Volunteer Office, 4400 Forbes Avenue, Pittsburgh, PA 15213; (412) 578-2497; sippelg@CarnegieMuseums.org; www.carnegiemuseums.org/cmnh/
Through the Teen Docent Program, 15-20 students are trained to serve as museum guides in the Alcoa Foundation Hall of American Indians, Dinosaur Hall, and the Hall of African Wildlife. The application deadline is in early January.

The Cleveland Museum of Natural History
Volunteer Coordinator, The Cleveland Museum of Natural History, 1 Wade Oval Drive, University Circle, Cleveland, OH 44106-1767; (216) 231-4600, x349; volunteer@cmnh.org; www.cmnh.org/fun/volunteer.html
Students age 14 and up who can commit to long-term service at the museum may volunteer in the Wildlife Resources Center and the Discovery Center.

The Field Museum of Natural History
Manager of Volunteer Services, The Field Museum, 1400 S. Lake Shore Drive, Chicago, IL 60605-2496; (312) 665-7277; www.fmnh.org/museum_info/volunteer_opportunities.htm
Students age 14 and up may apply to volunteer to work on exhibits during the summer; those age 16 and older may apply for year-round volunteer positions.

Historic St. Mary's City (Outdoor Museum of History and Archaeology)
P.O. Box 39, St. Mary's City, MD 20686; (800) 762-1634; hsmc@osprey.smcm.edu; www.smcm.edu/hsmc/
Students ages 10-15 may participate in the Youth Interpreter Program at this historic site.

The Metropolitan Museum of Art
High School Apprenticeship Program, Metropolitan Museum of Art, 1000 Fifth Avenue at 82nd Street; New York, NY 10028-0198; (212) 570-3961; www.metmuseum.org/education/er_apprenticeship.as
Through a competitive application process, high school juniors and seniors are considered for the summer program; fall and spring semester apprentices must be seniors. Students are assigned to a department—curatorial, education, administrative, or libraries—and are paid an honorarium.

Natural History Museum of Los Angeles County
900 Exposition Boulevard, Los Angeles, CA 90007; (213) 763-3466; www.nmh.org
Students age 14 and up are accepted as volunteers. While most students work during the summer as teachers' aides, the museum does make other arrangements with students who have specific interests at the museum.

University of Pennsylvania Museum of Archaeology and Anthropology
33rd & Spruce Streets,Philadelphia, PA 19104; (215) 898-4001; idag@sas.upenn.edu; www.upenn.edu/museum/
Junior high and high school students are placed into volunteerships depending on their interests, availability, and the museum's needs.

OF MUSTARD SEEDS AND MEN:

A Story of Molecular Anthropology

by Sohini Ramachandran

To most people, genetics is a science of the future, one that will give us unprecedented opportunities to understand and modify life. Genetics is simultaneously a science of the past. Our DNA is an unbroken link to our ancestors. Now that we have the technology to access this immense historical database, geneticists have joined with anthropologists and archaeologists to explore man's ancient past. Geneticists use different tools—DNA sequencers instead of shovels and trowels—and look at different artifacts—DNA strands instead of tools and tombs. With my 1998 Science Talent Search (STS) project, I made what I hope will be my first of many contributions to this exciting field of study.

The Road to the Bering Strait

My own entry into this field was unintentional. I wanted to complete a project for the STS, and as a student with strong mathematical abilities, I went looking for ways to apply mathematics to genetics. That's when I first learned about microsatellites: non-coding regions of DNA where the same combination of DNA base pairs are repeated up to 100 times. For example, one segment might have 28 consecutive repeats of the combination CA (cytosine and adenine). What caught my attention was the fact that each microsatellite could be expressed in terms of *a number*. That made DNA amenable to mathematical analysis.

My research was conducted in Dr. Marcus Feldman's population genetics lab at Stanford University, where I continue to work as a research assistant. Stanford is home to an amazing group of scientists who use genetics, statistics, and sophisticated computer modeling to study human evolution. [Editor's note: see sidebar.]

The Bering Strait. The area that is now shallow water was dry land thousands of years ago. Photo courtesy of NOAA Paleoclimatology Program.

By mapping the genomes of organisms, gathering repeat scores for each microsatellite region, then performing statistical comparisons, we can compute a value for the genetic difference or "genetic distance" between two organisms. Genetic distance measurements allow us to say how genetically similar and therefore how closely related two organisms are. Using such data, we can create a phylogenetic tree, a pictorial representation of the genetic relatedness of various organisms. Finally, by taking into account DNA's mutation rate, we can estimate how long it's been since two organisms had a common ancestor—that is, how long since they went their separate ways.

My STS project involved looking at 20 microsatellite regions in 42 *Arabidopsis thaliana* plants from around the world. *Arabidopsis*, or wild mustard, has no natural mechanism to disperse its seed—no burrs to catch on the coats of passing animals, no feathery tuft to enable it to float in the wind. Nor is it a plant that humans were likely to have transported intentionally; unlike some mustards, *A. thaliana* was never cultivated by humans as a seasoning. It's just a weed. Despite these limitations, *Arabidopsis* managed to leave its botanical origins in Northern Africa and spread all over the world. Its global expansion is thought to have occurred as *Arabidopsis* seeds were shuffled along by passing animals and humans.

One relocation of *Arabidopsis* seeds occurred relatively recently, historically

speaking. Records from a ship that sailed from Spain to the New World in the early 1500s reveal that a shipment of mustard and grain seeds included some *Arabidopsis* seed. When I began my work, I wondered whether I would find that the Spaniards had been the first to bring *Arabidopsis* to the Americas, during the Age of Colonialism.

Using statistical analyses of the microsatellite data, I could test different hypothetical phylogenetic trees for the samples I had. While some New World *Arabidopsis* plants can probably claim those Spanish stowaways as their ancestors, the plants in my data set could not. Comparing the Old and New World specimens in my study, I found that the plant groups split much earlier than the Age of Colonialism. My calculations suggested that the New World variants had separated from the Old World plants about 30,000 years ago. This date coincides approximately with the earliest proposed large migration of humans across the Bering Strait Land Bridge at the end of the Ice Age—an intriguing result. Suddenly, a study that was originally about the botanical history of a plant offered insight into human history.

Part of a Bigger Puzzle

My *Arabidopsis* results catapulted me into what is currently a major dispute between traditional anthropologists and the scientists who are using DNA to explore the ancient past. The oldest undisputable archaeological evidence (in the form of tools and pottery) for human habitation of the New World is about 12,000 years old. But archaeological remains are only one kind of record of the past. DNA is another. Genetic studies of plants and, more importantly, of humans suggest that the first major human migration across the Bering Strait occurred roughly 20,000 years ago. Archaeologists have evidence to suggest only one migration to the Americas, whereas geneticists find evidence suggesting that there were two or three major migrations over an interval of about 7,000 years. These estimates are based on genetic studies of aboriginal humans from all over the world, ranging from Eskimos to Mayans to Native Americans to Africans.

I began my STS research over three years ago as a mathematician in search of a genetics project. In the process, I discovered and fell in love with an exciting new field that combines many of my interests. This past summer, I began a new plant genetics study in Dr. Feldman's lab, this time involving barley and wheat, plants that humans cultivated. We have data from populations of both wild and cultivated wheat and barley from the Fertile Crescent, the cradle of the first civilizations. Microsatellite comparisons of these samples are giving us an idea about when these grains were originally domesticated by humans. And that helps us better understand the development of agriculture and of human civilization.

Even as this sort of research moves us closer to understanding more about our past, it's clear that genetics' contributions to our understanding of ourselves and our world have only begun. I continue to be amazed at the power of genetics to answer questions about the past and to create possibilities for the future. I am delighted to have found a field so full of opportunities, one that I plan to spend a lifetime delving into.

***Sohini Ramachandran** was awarded Fourth Place in the 1998 Science Talent Search for her project, "Homo sapiens and Arabidopsis thaliana: Mathematical and Computer-Intensive Studies of Geographic Molecular Variation." Now a junior at Stanford University majoring in mathematical and computational sciences, she plans to pursue a Ph.D. in computational biology so she can continue research in the field of genetics.*

To learn about the STS, see www.sciserv.org/sts/

The Father of Molecular Anthropology

Now that the human genome has been sequenced, the genetic "book of life" lies open before us. But long before DNA-sequencing technology made it possible to examine DNA, a few innovative scientists found clever ways to use genetics to address anthropological questions. Stanford University professor Luigi Luca Cavalli-Sforza has been a pioneer in the use of genetics to study man's family tree. While physical anthropologists compared the physiognomy of the peoples of the world, trying to deduce which peoples were most closely related, Cavalli-Sforza realized that genetic similarities and differences would provide a more impartial measure of relatedness.

When he began his research over 40 years ago, he could not study DNA directly—the tools simply did not exist—but he could study variations in phenotype. He analyzed the distribution of various proteins, like the HLA blood-group antigens, among the peoples of the world. By looking at the global distributions of a large number of proteins that have several different alleles, and by analyzing the proportion of shared alleles between populations, he was able to generate a family tree of the peoples of the world. He later used this tree to help map the major global migrations of humans. His work answered some questions that physical anthropologists had been unable to resolve, such as the relationship between Pacific Islanders and Native Americans, and showed how valuable genetic variation could be in revealing near and distant relations among members of a species.

Today, molecular anthropologists can look beyond phenotype to underlying variations in DNA sequence. And they can study not only coding regions but also the vast expanses of non-coding DNA, which make up the majority of the DNA in higher organisms like humans. We have just begun to read this historical record.

For Further Reading

The Great Human Diasporas: The History of Diversity and Evolution by Luigi Luca Cavalli-Sforza, *et al.* (Perseus Press, 1996).

Genes, Peoples, and Languages by Luigi Luca Cavalli-Sforza (North Point Press, 2000).

THE PILTDOWN MAN HOAX

Almost 100 years ago, someone planted an assortment of bones in an archaeological dig and watched as the scientific community recast them as our earliest human ancestor. Even now, the Piltdown Man hoax remains one of the most mysterious and controversial incidents in the history of anthropology.

By Laura Orem

In 1908, a kindly, genial lawyer named Charles Dawson approached a group of workmen digging a pit in the village of Piltdown in southern England. He was a collector of fossils, he told them, and would pay good money for any specimens they might come across.

It was not an unusual request. Fossil hunting and trading were something of a rage in England. Many amateur paleontologists became quite adept at finding specimens and often worked closely with professional scientists. Dawson himself was an Honorary Collector for the British Museum of Natural History, which had acquired his extensive fossil collection. He even had three discoveries of prehistoric species to his credit.

One of the workmen soon brought him some fragments of a fossilized human skull. But it wasn't until 1911, after Dawson found more fragments and the fossilized teeth of an ancient hippopotamus and elephant, that he showed them to a colleague. Arthur Smith Woodward was keeper of geology at the British Museum and a specialist in fossil reptiles and fish. To Woodward, the teeth seemed to be pre-Pleistocene (over two million years old), which suggested that, since they were found with the skull fragments, the skull must be pretty old, too. From the color and state of fossilization, he estimated its age to be 200,000 to 300,000 years.

At this point, suspecting they were on to something, Dawson contacted another friend, a French Jesuit priest and amateur paleontologist, Teilhard de Chardin. Chardin agreed to help Dawson and Woodward further explore the pit at Piltdown. Perhaps the skull fragments might even belong to the famous "missing link" everyone was trying to find.

The Missing Link

In 1857, Charles Darwin published *The Origin of Species*, the landmark book which claimed that all living creatures on earth had evolved from earlier, more primitive creatures. If Darwin was right, scientists reasoned, then there must have been a "missing link" in our evolutionary chain: the connection between prehistoric apes and modern man. They believed that the missing link would be ape-like in posture, but have a large brain. He would have apish facial features, but be recognizable as our ancestor through his ability to make tools.

In 1891, fossilized bones of an ancient hominid (erect primate) were found on the Pacific island of Java. *Pithecanthropus erectus*, or Java Man, was a toolmaker. But surprisingly, he had a head that was thick and sloping like an ape's, and his leg bones were identical to a modern human being's. Could he be the missing link?

Many scientists said no. Java Man's brain was too small, and his posture was too good. He must be an anomaly, or a mistake. More importantly, he had lived on an island in the South Pacific, not in England or France. According to prevailing scientific wisdom, the missing link would have originated in Western Europe, the home of civilized man, not in places like the South Pacific, Far East, or Africa. It was only a matter of time before specimens would be found to confirm this. British, French, and German scientists raced to see which country would claim the earliest example of man.

The First Englishman

Dawson, Chardin, and Woodward returned to the pit at Piltdown to see what else they could dig up. Among other fossils, they found more skull fragments, some flints (could they be ancient tools?), and, miraculously it seemed, a hand ax.

Then, even more miraculously, Dawson unearthed a mandible, or jawbone, complete with two intact molars. Did it belong to the skull? The jaw was very similar to a modern ape's in shape, but the molars exhibited the wear and tear of human teeth. A capacious human skull, an apelike jaw with humanlike teeth, and an ancient tool, all together in one place. It seemed only logical that the owner of the skull was the owner of the jaw, and that he had made the hand ax. They had found the missing link.

In November 1912, Dawson, Woodward, and Chardin announced to the world that they had found our earliest ancestor, *Eoanthropus dawsoni* (Dawson's Dawn Man), or Piltdown Man. Piltdown

Man gained stature in the scientific community as he gained influential supporters. These included W.J. Sollas, professor of geology at Oxford; Reginald Smith, curator of antiquities at the British Museum; W.P. Pycraft, curator of anthropology at the Musueum; and Arthur Keith, conservator of the Royal College of Surgeons and an expert on anatomy.

Adding more weight to the evidence, in 1913 Chardin uncovered a hominid canine tooth at the pit, and, in 1914, a tool made from the fossilized thighbone of a prehistoric elephant. Clever journalists remarked how similar the tool looked to a cricket bat. Many scientific books and articles appeared, championing Piltdown Man as "the first Englishman."

Doubts Begin to Stir

Despite such eminent supporters, there were those who doubted Piltdown Man. He just didn't seem to fit anywhere. His jaw was too apelike, and when the canine tooth was closely examined, some scientists claimed that it could not have fit in his mouth. And, oddly, while the molars in the jaw seemed to be mature teeth, the canine, despite evidence of wear and tear, appeared to be a milk or baby tooth. How could the teeth have come from the same individual? The tools, too, were bothersome. Could Piltdown Man, primitive as he was, have made them?

Meanwhile, other paleontological research continued. In 1924, Raymond Dart discovered the fossilized bones of an early hominid in South Africa: *Australopithecus africanus*, or the Taung Child. Dart was laughed at when he claimed the Taung Child as an ancestor of humans. Australopithecus had a tiny brain, upright posture, and came from Africa; Arthur Keith insisted it was a chimp or gorilla, and called Dart "flighty." In 1929, *Sinanthropus pekinensis*, or Peking Man, was discovered in China.(Peking Man and Java Man were both later reclassified as *Homo erectus*). These bones were clearly human, clearly ancient (about 500,000 years old), and made Piltdown Man's presence on the evolutionary ladder even more puzzling. How could Peking Man, with his evolved human jaw, be older than Piltdown Man, with his less-evolved jaw?

Some in-depth investigation seemed in order.

The Hoax is Exposed

Early in the century, the age of fossils was determined largely by where they were found and what other fossils were found with them. But, starting in the 1930s, scientists were able to chemically and radiographically age-test the Piltdown fossils in various ways. At first, the results were ambiguous and puzzling, but as technology progressed, the tests became more accurate. Finally, in 1953, the results were announced:

Piltdown Man's skull was that of a 40-year-old woman, who lived no more than 500 years earlier.

The jaw was that of a modern orangutan, also about 500 years old, and the canine tooth belonged to a prehistoric chimpanzee. The skull fragments had been chemically darkened, and the jaw and tooth painted, to simulate great age.

Both the molars in the jaw and the canine tooth had been filed with something metal to simulate wear and tear. The "cricket bat" had also been filed and shaped with a modern metal tool.

The flint tools and hand ax came from sites in another part of England. They were old, but had probably been altered to look older. Some of the other fossils found with the skull were not from England at all. The elephant tooth came from a dig in Tunisia, and the hippopotamus tooth had journeyed all the way from a limestone cave on the island of Malta.

In other words, the jaw, canine tooth, tools, and animal teeth had been planted in the Piltdown pit. The skull fragments may also have been a plant, or could indeed have come from someone who had been buried at the site 500 years before.

But who could have planted them, and why? And how could so many experienced, intelligent scientists have been fooled for over 40 years?

Solving the Mystery

The hoaxer planted the fossils over a period of years. Was it Dawson? A jealous colleague? An anti-Darwin cleric who wanted to disprove the theory of evolution? Or could it even have been Sir Arthur Conan Doyle, creator of Sherlock Holmes, great friend of Dawson, and known lover of practical jokes?

We probably will never know for sure. All the main characters in the discovery had the knowledge, equipment, and access to the pit necessary to perpetrate the hoax, and all could be ascribed reasonable motives. All of them also had reputations and careers to lose, should the hoax be discovered. All of them were considered honorable men by their contemporaries. No one ever confessed.

Perhaps what is more important, and easier to unravel, is how such an obvious forgery was able to fool such eminent scientists. Anyone holding the skull fragments and the jaw at the same time should have been able to tell that the skull had fossilized and the jaw had not. A close look at the jaw and canine would have revealed their coats of paint. Some thorough X-rays would have shown the teeth to have been filed down.

The answer lies in two grievous flaws in the reasoning of the men involved: a disregard for scientific method, and the deeply ingrained racial prejudice of the era. The scientists and educated amateurs all made the mistake of fitting the evidence to their pre-conceived theories of what the "missing link" should be, instead of coming up with a reasonable theory to fit all the evidence. And if the evidence was a little shaky, better not to examine it too closely. (Very few scientists were allowed to

Continued on page 29

How could so many experienced, intelligent scientists have been fooled for over 40 years?

Archaeology News from Around the World

As this issue was going to press, we were overwhelmed by the number of archaeology stories in the news. We've included a few of the most fascinating stories here, but countless discoveries are just waiting to be made. So keep your eyes on the newspaper, and check out some of the programs spotlighted in this issue to see how you can get involved.

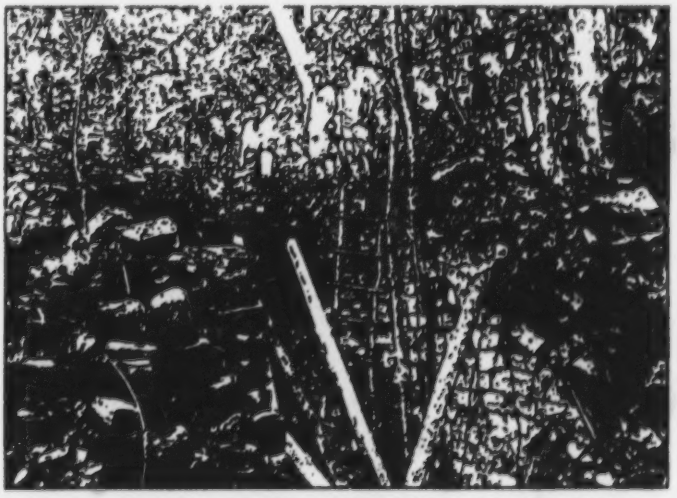
Tales from the Crypt

It's hard to believe that a donkey's lack of balance led to the discovery of the amazing Valley of the Golden Mummies, but it's true. An Antiquities guard of the Temple of Alexander the Great was crossing the desert when his donkey tripped, hitting its leg on the edge of a tomb. Dr. Zahi Hawass, Undersecretary of the State for the Giza Monuments and Director of the Pyramids, was alerted of the discovery and put in charge of the excavations at the Bahariya Oasis, located about 236 miles west of the Giza Pyramids.

"This excavation revived the adventurous spirit of archaeology inside all of us who worked at Bahariya, because we were not merely uncovering the objects used by people or the tombs they were buried in, we were uncovering the very people who made them," he said. At that time, four tombs were excavated and the archaeology team found 105 well-preserved, beautifully gilded mummies. "I could not believe that such beautiful mummies could exist. Their eyes were looking at me as if they were real people," said Dr. Hawass.

A year later, Dr. Hawass noticed a space under one of the walls, which ultimately led to the discovery of more mummies. He said, "I looked on my left and right sides and saw that lots of mummies had appeared. There were mummies of children, men, and women, many in good condition. No one can describe such a scene ... it was a festival of mummies."

Scholars have estimated that several hundred tombs and as many as 10,000 mummies are just waiting to be uncovered within the vast cemeteries of Bahariya. Visit Dr. Hawass's Web site at *http://guardians.net/hawass* to read more about this amazing discovery.



An excavation of a room in a royal palace built by the Maya people. Archaeologists from Vanderbilt University and Guatemala are excavating the three-story, 170-room palace at Cancuén, Guatemala, which was unusual in its design and fine masonry. The project has support from the National Geographic Society. Photo © Christopher Talbot/National Geographic Society.

Fit for Kings

Dr. Arthur Demarest, an archaeologist at Vanderbilt University, literally fell into his work while in a remote jungle of Guatemala. While walking among the remains of Cancun, he fell up to his armpits into vegetation. "That's when I realized the entire hill was a three-story building and we were walking on top of the roof," he said.

What Dr. Demarest uncovered that day was one of the largest, most elaborate, and best preserved palaces of Mayan kings ever discovered. More than 170 rooms with high ceilings and 11 courtyards sprawl over an area greater than the length of two football fields. Earlier expeditions had either overlooked or underestimated the size and splendor of the palace and the city around it, a prosperous center of commerce at the head of navigation on the Pasión River.

"This site is very important because it changes some of the perspective on Mayan states," said Dr. Demarest. "The basis of royal power among the Maya was religion and warfare. But Cancun has no temples, no defense, no evidence of warfare, no evidence of important wars. Instead, hieroglyphs at the site suggest that the business of Cancun was business, and that the city prospered by making political alliances on a Machiavellian scale."

Read about Dr. Demarest's efforts to re-create this Mayan palace at *www.vanderbilt.edu/News/news/sept00/nr8b.html*

[illegible] in Syria

It started with a pot. And then another, and then another.

These pots told Dr. Glenn Schwartz, professor of Near Eastern studies at Johns Hopkins University and Dr. Hans Curvers from the University of Amsterdam, that their team of archaeologists had discovered an undisturbed structure. And the pottery told them it was much older than anticipated. The team of archaeologists delved into a world that had not been disturbed for about 4,300 years—human and animal remains, gold and silver treasures, and unbroken artifacts lay all around them.

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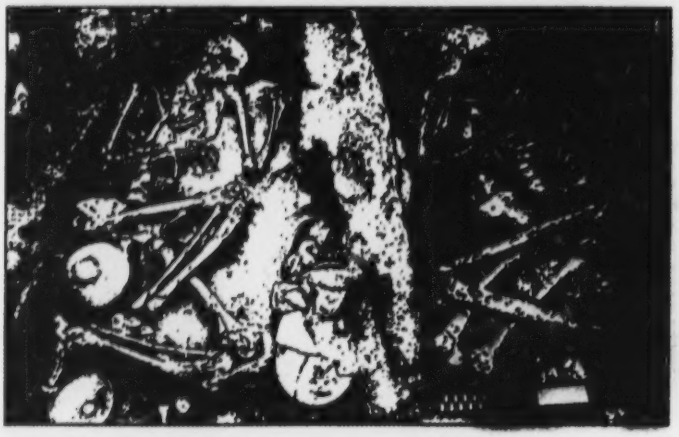
What they found was an ancient, untouched tomb of what may be royalty. On the top level were two young women in their 20s, both adorned head to toe in jewelry of gold, silver, and lapis lazuli, and each with a baby at her side. Below were two adult males and the remains of another baby off to the side. One of the adults was crowned with a silver diadem and the other adult held a bronze dagger. On the lowest level, an older male held a silver cup and silver pins.

The site is located at Umm el-Marra. "This is one of the earliest urban civilizations in the world," said Dr. Schwartz. "By studying Syria, we can learn more about the different ways urban societies developed, why they developed when and how they did, and how they differed from each other. It's an important addition to our understanding of why cities, writing, states, and social classes first developed."

Visit *www.jhu.edu/news_info/news/home94/may94/syria.html* and *www.jhu.edu/news_info/news/home95/sep95/archtips.html* for findings from Johns Hopkins University's Umm el-Marra excavations.

Under the Sea

A robotic submersible has come one step closer to identifying the inspiration for the Biblical story of Noah's flood. A team led by Dr. Robert Ballard, founder and head of the Institute for Exploration at the Mystic Aquarium and who is perhaps best known for finding the wrecked *Titanic*, discovered the outlines of an ancient coast 550 feet below the current waterline of the Black Sea. This was visual evidence that a flood had occurred in the region ages ago.



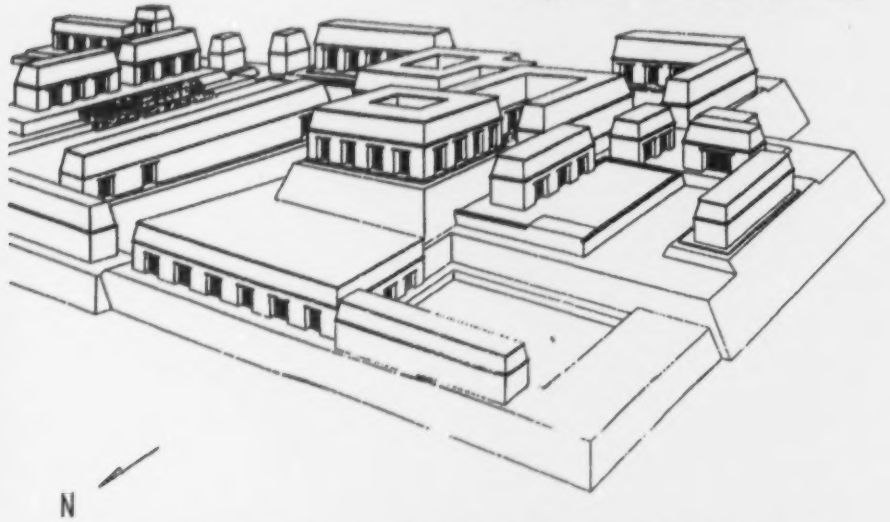
Skeletons of two men found in the second layer of an ancient tomb in Syria. Photo © Glenn Schwartz.

The researchers began their expedition 12 miles east of the Turkish port city Synope, using special "side-scan" sonar to map anomalies on the sea floor. They then sent a robotic submersible to investigate the most promising sites. What they found was a collapsed rectangular building 39 feet long and 13 feet wide at 311 feet below the surface. Dr. Frederik Hiebert, a professor at the University of Pennsylvania and chief archaeologist on the expedition, said, "This is a discovery of world importance ... this discovery will begin to rewrite the history of cultures in this key area between Europe, Asia, and the ancient Middle East."

Carved wood beams, planks, tree branches, and chunks of wood that were untouched by worms or mollusks suggest that the anoxic waters of the Black Sea may also be sheltering intact shipwrecks in its sterile depths. "It is beyond our wildest imagination," said Dr. Ballard. "Wood is existing much shallower than we thought. When we go deep, it can only get better," he said.

At press time, Dr. Ballard was planning the first ever exploration of the Black Sea floor, so keep your eyes and ears open for the latest developments. To learn more, go to *www.nationalgeographic.com/blacksea*

—Michelle Burkhart



Artist's conception of a section of the sprawling palace built 1,300 years ago by the Maya at Cancuén. The excavation of this palace is sponsored by Guatemala's Institute of Anthropology and History, the National Geographic Society, and Vanderbilt University. Drawing © Luis Fernando Luin/National Geographic Society.

Gold pendant found among the women buried in the top layer of the Syrian tomb. Photo © Glenn Schwartz.

The Maya people of Cancuén left behind this burial vase, decorated with geometric designs. The vase is one of numerous artifacts found at Cancuén. Photo © Christopher Talbot/National Geographic Society.

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SELECTED RESOURCES IN Anthropology and Archaeology

WEB SITES

The Internet is rich with information about archaeology and anthropology. Some of these sites offer extensive links, so be prepared to spend a lot of time exploring.

Anthropologists at Work
anthap.oakland.edu/napafaq.htm
The National Association for the Practice of Anthropology created this site as a companion to the video *Anthropologists at Work: Careers Making a Difference* (available by calling (703) 528-1902), but the information really stands alone.

Anthropology in the News
www.tamu.edu/anthropology/news.html
Wondering what's new in the world of anthropology? This site is a great way to keep current, with links to news stories published on the Web by a variety of sources.

Anthropology on the Internet for K-12
www.sil.si.edu/SILPublications/Anthropology-K12/
A compilation of annotated links to anthropology Web sites appropriate for teachers and students. Learn about careers, museums, publications, associations, and more.

Careers in Anthropology & Archaeology
www.review.com/careers/
This site requires you to register, but once you do, you'll have access to in-depth profiles of a variety of careers, including anthropology and archaeology. You'll learn what kind of education you'll need; what to expect two, five, and ten years out of school; salaries; major employers; and more.

Frequently Asked Questions About a Career in Archaeology in the U.S.
www.museum.state.il.us/ismdepts/anthro/dlcfaq.htm l
This site offers an anthropology professor's valuable responses to questions about education, volunteering, careers, and more.

StudyWeb's Links to Museums
www.studyweb.com/links/4297.html
Check out archaeology and anthropology exhibits at museums around the world.

GET INVOLVED

You can find some great archaeology programs in your own back yard. Start with these, but don't forget to check out pages 6-13 for summer programs in archaeology. And be sure to visit www.jhu.edu/gifted/imagine/links_82.html for links to all of this issue's featured programs and more.

Archaeology Weeks/Months
www.cr.nps.gov/aad/statearc.htm
Forty-four states celebrate archaeology with events taking place over a week or a month. Activities include lectures, open houses, open field days, exhibits, and other opportunities to explore archaeology in your own community. Visit the Web site for your state's dates and contact information.

National Park Service VIP (Volunteers in Parks)
www.nps.gov/volunteer/index.htm
Many parks offer volunteer opportunities, so if you live near a national park, you might be able to participate in archaeological research taking place there. Check this index of openings or call your local branch of the NPS to inquire.

BOOKS

Hundreds of books on archaeological and anthropological topics have been published in recent years. Browse your library or favorite bookstore for many more titles not listed here.

Ancient Egypt: The Great Discoveries by Nicholas Reeves (Thames & Hudson, 2000). Beginning with the Rosetta Stone and ending in the Valley of the Golden Mummies, this book tells the story of Ancient Egypt as revealed through archaeological discovery. The book includes excerpts from notebooks and diaries of excavators as well as 350 illustrations.

The Bone Lady: Life as a Forensic Anthropologist by Mary H. Manhein (Penguin, 1999). What happens when bones are the only clues to a crime? In this fascinating book, Manhein shares stories of how she has used forensic science to help investigate crimes (many of them famous).

Bones of Contention: Controversies in the Search for Human Origins by Roger Lewin (University of Chicago Press, 1997). Approaching such discoveries as Neanderthal Man, the Taung Child, and Lucy as detective stories, Lewin offers a look at how controversy and contention have flourished in the field of paleoanthropology.

Eyewitness to Discovery: First-Person Accounts of More Than Fifty of the World's Greatest Archaeological Discoveries by Brian M. Fagan, ed. (Oxford University Press, 1998). What was it like to discover the tomb of Tutankhamun, Otzi the Iceman, or the Machu Picchu? This book lets you hear about such findings from the people who were there.

The Serpent and the Rainbow, Reissue Edition by Wade Davis (Touchstone Books, 1997). First released in 1985, this book tells the story of Davis's journey into the Haitian jungle in search of "zombie powder" and the antidote. The result is a combination of adventure and anthropology that sheds light on the Haitian culture and people. (Note that the book is very unlike the movie of the same name.)

Skull Wars: Kennewick Man, Archeology, and the Battle for Native American Identity by David Hurst Thomas (Basic Books, 2000). When Kennewick Man, a 9,000-year-old skeleton, washed out of the Columbia River in 1996, archaeologists wanted to study the skeleton, while Native Americans wanted to provide him a proper burial. The debate turned into a lawsuit. Thomas's thoroughly researched account of the controversy allows readers to draw their own conclusions.

MAGAZINES

Archaeology
A publication of the Archaeological Institute of America, *Archaeology* offers news and features appropriate for a general readership. Call (877) 275-9782 or visit www.archaeology. org to order.

The online version offers not only the latest news in archaeology, but also virtual digs, where you can read personal accounts written by archaeologists and students.

Discovering Archaeology
This magazine for students and the general public comes from the publishers of *Scientific American*. Call (877) 347-2724 or visit www.discoveringarchaeology. com to order. The Web site contains news, book reviews, feature articles, and registration for a free e-mail newsletter.

ORGANIZATIONS TO CONTACT

The Web sites of these organizations provide a great introduction to the fields of anthropology and archaeology. You can also contact organization representatives for more specific information about how you might become involved in these fields now.

American Anthropological Association
4350 North Fairfax Drive, Suite 640, Arlington, VA 22203-1620; (703) 528-1902; www.aaanet.org
The Web site is written primarily for professional anthropologists, but the "What is Anthropology" page as well as the page of links contain a lot of useful information for students.

Archaeological Institute of America
Archaeological Institute of America, Boston University, 656 Beacon Street, 4th Floor, Boston, MA 02215-2006; (617) 353-9361; aia@bu.edu; www.archaeological.org
Both professional archaeologists and interested amateurs comprise the membership of the AIA. The Local Societies sponsor lectures, field trips, films, and museum visits. You can find your Local Society on the Web site.

National Association of State Archaeologists
http://nasa.uconn.edu/
Did you know that each state has a State Archaeologist? Link to your SA from this Web site and find out about archaeological opportunities in your community.

Society for Historical Archaeology
P.O. Box 30446, Tucson, AZ 85751; (520) 886-8006; sha@azstarnet.com; www.sha.org
Some of the material on the SHA Web site is adapted from two pamphlets: *Mapping Out a Career in Historical Archaeology* (for middle school students) and *Careers in Historical Archaeology* (for older students). Call or write to SHA to order.

HOW I BECAME A SEED OF PE

by Rachel Culley

When I arrived at Seeds of Peace camp in Otisfield, Maine, I'd never met anyone from the Middle East. I knew hardly anything about the Arab/Israeli conflict. Although I was excited to have been selected to attend, I didn't realize the importance of what I would be doing or how it would affect my life months after I left.

When I arrived, I was assigned to a cabin with two girls from Israel, one from Egypt, one from Turkey, two from Palestine, and three Americans. We were all issued green Seeds of Peace t-shirts, which we had to wear at all times. A "speak English" rule was put into effect. We celebrated the beginning of our Seeds of Peace experience with a flag-raising ceremony, during which every delegation raised the flag of their country and sang their national anthem, and then we all sang the Seeds of Peace anthem.

The first week we spent mainly having fun. The campers were divided into "coexistence" groups. My group included six Israeli kids, four Palestinians, one Egyptian, one Jordanian, and me. We spent the entire day together, playing sports, swimming, doing crafts and other camp activities, as well as participating in our coexistence

THE SEEDS OF PEACE ANTHEM

I am a seed of peace, seed of peace, seed of peace.
I am a seed, a seed of peace.
I am a seed, I am a seed of peace.
Peace, peace, peace, peace.
People of peace, rejoice, rejoice,
For we have united into one voice.
A voice of peace and hate of war.
United hands have built a bridge between two shores.
We on the shores have torn down the wall.
We stand hand in hand as we watch the bridge fall.
We learn from the past and fear not what's ahead.
I know I'll not walk alone, but with a friend instead.

sessions, where we talked about issues surrounding the conflicts.

Then the cousin of a boy at camp died from wounds he received from an Israeli soldier.

"Make One Friend"

In my journal, I wrote, "Everything is different. This is not about games anymore. This conflict is real. All the kids are scared, upset. I see it with my own eyes—see the tears that these kids are crying. This is real. Real people. Real pain—on both sides."

In the next coexistence session, the boy spoke. He said, "We must work for peace. There must not be any more people killed with guns. My cousin must be the last one." Then John, the leader of the camp, emphasized that it was up to the campers to try to stop the cycle of violence by making one friend from the other side, by trying to know the enemy.

This was especially difficult for me to understand; as an American, I'd never experienced anything like this. I didn't know what it was like to live in conflict. The only thing I could do was try to relate to my friends as human beings and try to understand the emotions we all share.

After that day, I noticed people starting to work together. I watched girls from different countries put together a dance for the talent show. I saw campers playing drums and singing together as friends. And as I saw people cooperating, I learned about the religions, music, dances, costumes, and customs of my fellow Seeds. One day two kids from my group, a boy from Israel and a girl from Egypt, climbed the highest ropes course as a team.

The culmination of our working together came during the Color Games. The camp was divided into two teams, blue and green. We competed in everything from arts to canoeing to Frisbee. People learned how it felt to have a friend on the other team, and to work together with someone from another country. In the end, when my team won, all of us jumped into the lake, splashing and hugging. No one could tell who was blue or green, Israeli or Palestinian, friend or "enemy." Someone began singing the Seeds of Peace song, and we all joined hands in the water. It was the best moment of camp. In my journal, I wrote, "I don't care where they're from. I have the best friends in the world here."

Challenge for the Future

A few days later, we traveled to Washington, DC, and the Seeds spoke in Congress. Arms linked, two girls spoke about becoming friends. A boy from Israel read passages from his diary about how Seeds of Peace helped him change his view of "the other side." I spoke, too: "I hope the leaders here will continue to work for peace, because it is the most important thing you can do for us kids."

At the airport when it was time to leave, everyone was crying. I knew we would stay in touch through e-mail, visit each other, and spread the message of peace. As my bus pulled away, I saw the entire airport swarming with kids in green t-shirts.

The last entry in my journal is, "I will never look at the world in the same way. When I read the newspaper, I will see Menna and Hadeel and Abigail. I will see real kids like me. I will remember their bravery, spread the message. I am a Seed of Peace."

Epilogue

Three months later, I feel more a part of Seeds than ever. When I read *Seedsnet*, the online newsletter, I see how my friends feel about the increasing violence. Two weeks ago, a boy from Seeds of Peace was killed while he was peacefully protesting. He was wearing his green t-shirt. Situations like that make me wonder if it is possible for my friends to live in peace. But at the same time, my friends send e-mails filled with hope and determination. Those green shirts are made of a stronger cloth than I'd ever dreamed of.

I realize more and more how much of a responsibility it is to be a Seed of Peace. We have to try to spread the message of friendship, to inform those who don't know about the conflicts, to talk to our friends, our teachers, and our families, and someday, as the future leaders of our countries, we will continue the work that Seeds of Peace began in us.

Rachel Culley, 15, attends Kents Hill School in Maine. She enjoys writing poetry, photography, cross country and track, lacrosse, theater, and horseback riding. Rachel is a member of the Imagine Readers Panel.

SEEDS OF PEACE

John Wallach, an American journalist who covered the Middle East for 20 years, founded Seeds of Peace in response to the 1993 World Trade Center bombing. His hope was that by bringing together Arab and Israeli teenagers in a summer camp environment, they could accomplish something their governments could not: understanding, respect, and even friendship.

Since that first summer, 1,400 Arab and Israeli teenagers have graduated from Seeds of Peace, and 450 kids participate every year. The number of countries represented also continues to grow and now includes Israel, Palestine, Jordan, Egypt, Morocco, Tunisia, Qatar, and Yemen. A separate session for Greek Cypriot and Turkish Cypriot youths is also held each summer. In addition, a year-round program based at the program's Center for Coexistence in Jerusalem allows alumni Seeds to continue their work and to reach out to other youths.

Participants are selected for the summer program by their respective governments based on academic performance and leadership ability. An application for U.S. delegates is available on the Web.

For more information, contact Seeds of Peace, 1312 Wisconsin Avenue NW, Washington, DC 20007-3311; (202) 337-5530; fax (202) 337-5646; SeedsPeace@aol.com; www.seedsofpeace.org

Off the Shelf

Spoon River Anthology — Edgar Lee Masters

by Laura Orem

In 1915, a middle-aged attorney from Chicago named Edgar Lee Masters published his twelfth book of poetry. A novelistic chronicle of small-town American life, *Spoon River Anthology* inspired outrage while becoming a national bestseller. It also changed the literary landscape by its length (over 300 pages), use of colloquial language, and the unusual device of having the townspeople speak directly to the reader through their own epitaphs.

Masters' Spoon River is a fictional town in Illinois. The first-person epitaphs of the town's dead ("all, all, are sleeping on the hill") are used to create a picture of life there. Some of the inhabitants are famous or at least based on real people (Anne Rutledge, once beloved of Abraham Lincoln, and William Herndon, his friend and law partner), but most are ordinary characters, meant to represent types, not real individuals. The picture they paint is far from the idyllic depiction of white picket fences found in American literature of the day. Much like the inhabitants of Dante's *Inferno*, the townspeople, uninhibited because they are dead, lay bare the sins and follies of their lives and of each other in matter-of-fact free verse.

Hod Putt, in the first epitaph, confesses that he "Robbed a traveler one night in near Proctor's Grove/Killed him unwittingly by doing so,/For the which I was tried and hanged." Chase Henry, a few pages later, describes himself as "the town drunkard" and tells with glee how, "when the priest denied me burial/In holy ground," he ended up in the Protestant cemetery next to a banker, bringing "honor to the dead, who lived in shame."

A few epitaphs later, Judge Somers complains,

> *How does it happen, tell me,*
> *That I lie here unmarked, forgotten,*
> *While Chase Henry, the town drunkard,*
> *Has a marble block, topped by an urn...*

Right from the start, Masters has turned societal expectations upside down: the drunken sinner ends up better off than the sober judge.

But what was more disturbing to Masters' readers were the accusations the townspeople fling at one another. Amanda Barker says of her husband:

> *Henry got me with child,*
> *Knowing that I could not bring forth life*
> *Without losing my own.*
> *In my youth therefore I entered the portals of dust.*
> *Traveler, it is believed in the village where I lived*
> *That Henry loved me with a husband's love,*
> *But I proclaim from the dust*
> *That he slew me with his hatred.*

Besides dealing with a subject (marital relations) very few writers had ever touched upon, Masters here directly addresses the duplicity of small-town America, the passions and angers that lie beneath its genteel surface.

Masters also deflates the reputations of men and women who would, on the surface at least, seem to be pillars of the community. Minerva Jones, "the village poetess" with a "heavy body, cock-eye, and rolling walk" tells how the village thought her crazy and, "after a brutal hunt...left me to my fate with Doctor Meyers;/And I sank into death, growing numb from the feet up,/Like one stepping deeper and deeper into a stream of ice."

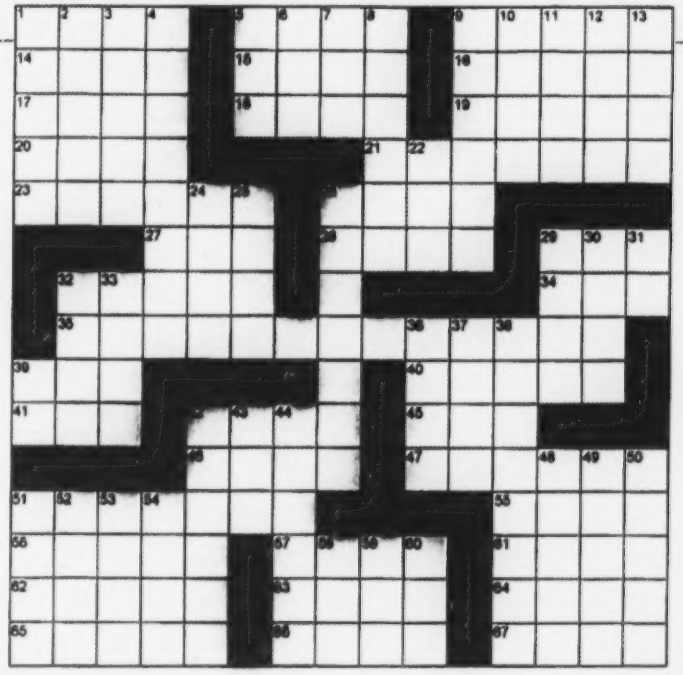
Doctor Meyers defends himself in the next epitaph, "I tried to help her out–she died/–they indicted me," sounding both defensive and petulant. The reader isn't quite sure what it is Doctor Meyers has done until his wife speaks in her own epitaph: "Poor soul so sunk in sin he could not see/That even trying to help her, as he called it,/He had broken the law human and divine." Implicitly, Masters has described a case of euthanasia. Contemporary readers were outraged and fascinated. They wrote indignant letters to the editor and bought the book in droves.

Unlike most books of poetry, which are fairly slim, *Spoon River Anthology* is over 300 pages long. Masters wanted to include an example for every kind of person he could imagine living in his town. Structurally, *Spoon River* is like a novel; more and more of the story unfolds with each epitaph. Until its publication, books of poetry were not usually linked thematically; each poem tended to stand alone as a separate entity. In addition, the townspeople use colloquial, matter-of-fact language; they sound like ordinary Americans. As such, the book broke ground beyond the heavily mannered, rhymed, and metered poetry of Masters' time. Its daring encompassed both form and content. No one had ever seen anything like it.

Spoon River Anthology was so successful that Masters was able to leave the legal profession (he had been a partner of famed attorney Clarence Darrow) and move to New York to write full-time. There, he received a prestigious fellowship award from the Academy of American Poets. While none of his subsequent books ever matched the broad appeal and monetary success of *Spoon River*, his contribution to American letters is undeniable. *Spoon River Anthology* remains as provocative, disturbing, and innovative as it was 85 years ago.

Word Wise: Ancient Worlds

by Carol Blackburn



ACROSS

1 Machu Picchu builder
5 Hoofed animal sacred to the Aztecs
9 Ritual markings
14 Approach
15 World's longest river
16 The Pentateuch
17 Poison-tipped weapon
18 1950s crooner Paul
19 Actor Christopher
20 Small town in southern Finland
21 With 26 Down, major 1947 archaeological find made by a shepherd boy (2 wds.)
23 Excavation tunnels
26 Partially (prefix)
27 An ISP
28 Hematocrit, in the ER
29 Tote
32 ___ coeur
34 Self
35 With 5 Down, matrilineal marker
39 Transgress
40 Red
41 Stuart, to his friends
42 Mark of authenticity
45 Only
46 Weight measurement
47 Homo sapiens
51 Remaining
55 Reaper's countenance
56 Ancient Mayan capitol, home of the Jaguar clan
57 Actress Beckinsale
61 "__ of the Ancient Mariner"
62 At an angle
63 Norse Zeus
64 Egyptian creator god
65 May be fossilized
66 City founded by twins suckled by a wolf
67 Fix

DOWN

1 Earliest known culture on the Indian subcontinent was in this river valley
2 Under (poetic)
3 Magna __
4 What an archaeologist hopes to find that no other scientist wants
5 See 35 Across
6 One (Ger.)
7 Relative of 5 Across
8 Lector
9 Bering __
10 Dorm dweller
11 Greek god of war
12 Praise
13 Famous stadium
22 Record label
24 Bull (Span.)
25 Second language education center (abbr.)
26 See 21 Across
29 Toxic element that may have contributed to the decline of the Roman Empire
30 Unattractive
31 Japanese board game
32 Smith, in Amsterdam
33 Descendents of the earliest human inhabitants of Japan
36 Let go
37 Ancient German letter
38 Chinese character
39 Nazi elite corps
42 Leg extenders
43 Long time
44 Remote-sensing photos taken from the space shuttle revealed previously undiscovered ruins at this ancient capitol of the Khmer empire
48 Kind of number
49 Lemon (Fr.)
50 Correct
51 Knife
52 Yugoslavian leader
53 Similar
54 University that sponsored the first excavation of Machu Picchu
58 Flurry
59 Actor Robbins
60 Suffix indicating a double bond

Solution on page 29

Exploring Career Options:
Television Journalism

by Carol Blackburn

A correspondent for ABCNews' 20/20 and PrimeTime, ***Cynthia McFadden*** *has made a career of covering challenging stories. As ABC's legal correspondent during the O.J. Simpson trial, she helped the nation understand the most sensational trial in history. Her work has received numerous awards, including two American Bar Association Silver Gavel Awards, for "outstanding efforts to foster public understanding of the law."*

When you were young, what did you want to do?

I grew up in a little town in Maine, and I never felt that I quite fit in there. I definitely had wanderlust. I also knew very early on that I wanted to be a journalist. I was in high school during Watergate, and I remember watching those hearings and thinking that Fred Graham, who was covering the proceedings for CBS, had the best job in America. He had a front row seat for this amazing historical event as the person whose job it was to explain it to us. So at an early age, I thought I might like to be a legal journalist. I wrote for my school newspaper and occasionally for the local newspaper.

You later went to Columbia University, but to the law school, not the school of journalism. Why?

The truth is, I didn't quite know how to get started as a journalist. After graduating from Bowdoin College, I decided to get a law degree so that I might become a legal journalist. Columbia has an excellent joint degree program between its schools of law and journalism, and I applied to the law school hoping to enter the joint program. Columbia didn't make it easy to do that, but they did let me take classes in the school of journalism while I was a law student. And that's how I got my first big break.

I was taking a journalism course on the First Amendment taught by Fred Friendly, the former President of CBS News. For one class, I was assigned to argue the government's position in the Pentagon Papers case. As I walked in, the TA said, "By the way, Floyd Abrams is here tonight." Abrams had represented *The New York Times*—the other side—in this landmark Supreme Court case, so when I heard that he was there, I was panic stricken. I went ahead with my argument, and at the end of class, Abrams said, "Fred, either you hire her as a journalist or I'm hiring her as a lawyer. It's your class, so you choose first." What a moment! For the rest of the time I was in law school, I worked for Fred as a research assistant. When I graduated, I went straight to work for him.

Wow! That was a break. What did you work on?

Fred was gearing up to do a series of moderated discussions for PBS on "The Media and Society." Each episode focused on a hypothetical situation or

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crisis, and the discussants were all famous people who played a role like their job in real life. So, for example, in a scenario about terrorism, Peter Jennings played the role of a network news anchor and fielded questions about how a major news network would react as the situation unfolded. Would they broadcast an interview with a terrorist? Would they tell the CIA what they knew about the terrorist's whereabouts, or would they protect the confidentiality of their source, knowing that it could cost lives? Each program had about 15 people representing different players in the scenario: the media, the White House, the CIA, law enforcement, the courts, the medical community, business. Over a period of seven years, we did thirty or so of these for PBS.

What were your responsibilities?

While I was in law school, I was a research assistant. A tremendous amount of academic research goes into the preparation for a program like this. It's very much like researching and writing a term paper. I later became a production assistant, and in that role, I would take the background information collected by research assistants and turn it into a hypothetical case-study for the television program. That was really tricky. Those programs seem spontaneous, and they are on the part of the discussants, but they weren't on the part of the moderators. We would give them 25-page outlines: Ask General Westmoreland A. If he says B, ask Peter Jennings X.

When I graduated from law school, the executive producer left, and I stepped in. I'm probably the only person in history who went straight from production assistant to executive producer. That sudden promotion put me in charge of casting the panels, scheduling, hiring, firing—I was in charge of the whole shebang, and I was 27.

It was a great experience. It was literally the case that I could call anyone in the country and say, "We're thinking about doing this. Will you speak with me?" and they would. One assignment was to talk Supreme Court justice Harry Blackmun into participating in a program on medical ethics. Initially, he turned us down cold, saying that no sitting Supreme Court justice had ever participated in a television program, and he wouldn't do it. As Fred and I were leaving his office, fueled by my 27-year-old chutzpah, I said, "You didn't ask him right. I would have turned you down too." So Fred said, "Okay, wise guy, you get him." I took a different approach, and I did. That series was my wonderful, romantic introduction to journalism.

After six years at PBS, you took another big step.

My story is such a strange mix of intention and coincidence. As a favor, I had produced a program for the Lifetime cable network, and at the last minute the woman who was supposed to anchor it got sick. Lifetime called and said, "You're going to have to anchor it." And I said, "But I'm the producer!" I ended up doing it, and it went well and was well reviewed.

Later, I got a phone call out of the blue from Steve Brill, at *The American Lawyer*. "I'm launching this court thing on television and I want to talk to you. I want you to be an anchor for this new network." I said, "But I'm a producer!" He had read the reviews of the Lifetime program and knew I had a law degree, and was convinced I was perfect for what he wanted. It was one of those moments when you ask, "Should I take the chance?" When you're young, I think you have to be willing to bet on yourself. I said to him, "You have no idea if I can do this and neither do I. So I will do it on one condition: that I can sign a one-year contract. Then, if I'm lousy at it, I can get out; and if I'm good at it, you'll have to renegotiate with me and pay me more." He agreed, and together with a lot of other people we started Court TV.

Is it uncommon to go from executive producer to being in front of the camera?

It's almost never done. Most people who aspire to careers as reporters start out at local stations, and few of them make the transition to the networks. However, the profession has changed a lot in the last few years. Cable is one way into the business, and expertise is another. We've entered the age of the specialist: if you know about politics or business or the legal system or technology, there are news markets for you.

What were your responsibilities as anchor and senior producer at Court TV?

As anchor, I would do a five-hour anchor shift every day, sometimes following three trials at a time. As a producer, I was responsible for helping to select the trials to cover, supervising and developing the research on how we would cover them, and choosing the guests we would have. When I was hired, I had insisted on being a producer, too, because that was the part of the job I knew I could do. I worked with Steve for a year before we went on the air, helping set up the network.

Between Court TV and later ABC, you have covered some of history's highest profile trials: the Menendez brothers, Jeffrey Dahmer, O.J. Simpson.

I covered 250 trials at Court TV and I thought, "Enough! I don't want to do any more trials!" I took a job as correspondent at ABC and, within four months, Nicole Brown Simpson and Ron Goldman were murdered. So I went to California and worked on the O.J. Simpson trial for the next year. So much for no more trials.

It was a great way to start out at ABC, full of things I had never done before. At

Continued on page 28

Court TV, I sat at the anchor desk and analyzed trials. During the Simpson trial, I was getting up at 2:30 a.m., appearing on *Good Morning America*, trying to take a shower without ruining my hair and make-up, getting dressed, going to court, coming out at noon (3 p.m. on the East Coast) to talk to Peter Jennings about what I might cover on *ABC News* that night, going back into the courtroom, out again at 3:00 (6:00 on the East Coast), briefing Peter Jennings about the rest of the day in court, going back to the bureau, filing whatever piece I was doing for that night, then frequently staying up to appear on *NightLine*. And then doing it all over again the next day. I was literally working around the clock. It was thrilling, and I had the opportunity to learn a lot in a very compressed period of time. I had no time for a personal life, but I just thrived on being fully immersed in the news environment.

What was most satisfying about covering those trials?

It was an opportunity to have a front row seat on history. With the O.J. Simpson trial, I think ABC did a good job of doing straight reporting about what was happening and explaining the context. At the end of the prosecution's case and then again when the defense rested, we did an hour special on each that laid out their main points. Years from now, when people want to understand what took place at the trial, beyond all the hype and the spectacle, I think those two hours will stand up very well.

It was also just plain exciting to be there. It was a very heady experience to be at the center of that vortex. I'm not sure it was always important, but it was always interesting.

Is it hard sometimes to maintain objectivity?

Yes. There are always a lot of things you can cover in a given story. You may like some people better than others, and want to cover them. I try to keep those prejudices out of my decisions. But all of us are inherently subjective. The best you can do is to strive to be fair.

Sometimes, though, even fair reporting produces a story that is much more favorable to one side than the other. Reality isn't always impartial. I'm doing an investigation now into the trafficking of young girls from small villages in India and Nepal to the Bombay brothels. The Indian mafia runs it, and the police take bribes and turn their heads. We've used hidden cameras to document all this. It's horrifying. But my job isn't to tell you that you should be horrified. It's to paint as accurate a picture of the world as I can, to make you aware of what's happening. But that doesn't mean that I don't have a strong point of view.

You no longer report on the news of the day. Now you develop stories and reports, like the one you just mentioned. Tell us about that process.

It's a very different undertaking from daily reporting. Each piece might take six months or longer from inception to airing. One of the first pieces I did was an hour on death row. I still can't talk about it without tearing up. It was overwhelming. It came about because I was asked to interview Susan Sarandon after *Dead Man Walking* came out. The producer thought I ought to interview the nun on whom Sarandon's character was based, and I agreed. The producer said, "I think I've talked the warden into letting you do that interview in the death chamber." So I went to Louisiana and interviewed Sister Helen Prejean, who turned out to be an amazing human being.

While I was there, the warden said, "I think *Dead Man Walking* was a great movie." I said, "Really? I think the movie was fine, but to be honest, if the American public expects you and people like you to execute people, I think they should understand what actually goes on in here." As we were leaving, he came up to me and said, "Cynthia, I want to take you somewhere, and your life is never going to be the same again." I had to leave the cameras and my producer outside. He took me through a series of eleven locked doors into death row, to a man named Antonio James, who was the next man scheduled to die. The warden told him, "This little lady wants to do a story about death row." We spoke for some time. Then, with the warden's permission, we moved in and filmed on death row for the next two months. It was the first time cameras had ever been allowed on a death row in this way.

The first interview was taped in January, 1996, and Antonio was executed in March. We spent weeks editing footage into a "network hour," which is only 38 minutes. And the show aired in June.

We got a lot of feedback from that show. People on both sides of the death penalty debate wrote and thanked us, saying that they saw things they had never known before. I was really proud of that hour for that reason. We showed the public a reality and let them draw their own conclusions.

What's the hardest thing about your job?

I see a lot of tragic, horrifying things in my line of work. We don't go to airports to cover planes landing safely; it's when a plane crashes that we're there. People's stories are so touching, and it's often very difficult to walk away, leaving them in a horrible situation. Leaving those Indian girls in those brothels, some of them locked in cages, was not easy. That's the hard part of this job—to both be open enough to tell people's stories and protect yourself enough to not go down with them.

Sometimes the traveling is difficult, too. But for the most part, I think I have the best job in America. I cannot believe that I have been so lucky.

With the proliferation of cable and the Web, is this is a good time for young people interested in television and multimedia journalism?

I think this is a wonderful time to consider journalism. There's a seismic change underway, and it will alter the business in ways we can't even imagine. In ten years, this business may be unrecognizable from what it is now. Having said that, I think there will always be a need to cover events—a need for people to get the stories, for people to check the facts of those stories, and for people to take pictures for those stories. The way the information is delivered will change, but the need for journalists who are fair and thoughtful won't go away. So I think if you want to be a journalist, if your passion is to try to understand the world and tell stories about it, this couldn't be a better time. ■

Ghana–continued from page 9

record the locations of the artifacts. We also noted places where the soil changed from the typical reddish-brown topsoil to dark brown or black, indicating a decomposed material.

Some of the most exciting parts of my experience took place when I worked at the cemetery site. Two days before I arrived, the team had discovered a human skull. They took the remains back to the lab, where they taught us how to study and handle delicate artifacts. This was a valuable lesson, because in the next days, we uncovered an animal jaw with teeth, pottery, tools, and animal remains.

I think I learned even more working at Dominaze, the village site. What we saw as we excavated told us a lot about the people who used to live there. Outside the foundations of homes, the black soil we had learned about earlier showed us where the residents had thrown their trash. The location of the artifacts also told us about life in the village: if they were scattered within a few feet of the foundation, we could envision the boundaries of the yard. The hearths found within the foundations told us that the residents had cooked inside; however, the presence of so many artifacts outside the foundations suggested that they spent much of their time outside the home.

We dug for hours on end under a bamboo tent while school children and villagers watched patiently. The children would follow us to the center of the village, singing, smiling, and chanting. Fascinated by my white skin, they poked me and touched my hair. I was intrigued by them as well, and I gave most of the kids school supplies as well as the majority of my clothes and medical supplies. Several of the people I met in the village still write me letters.

What we least looked forward to was packing up each day to leave the site. Exhausted already by the day's work, we knew that we still had to clean the hundreds of artifacts we'd uncovered. But when our work was done, we were rewarded with a home-cooked regional meal. Afterwards, we would go sightseeing, relocate for the evening to a local resort, or shop. Chris also gave a tour of the castles along the coast where slavery was common.

My fellowship was especially fulfilling because it introduced me to Ghana on two levels: I stood up to my waist in the history of a culture, and I interacted with people whose heritage is in that past. Working with real archaeologists helped me discover a world beyond the borders of my own country ... and beyond the boundaries of time.

*Now a freshman communications major at Northeastern University, **Jamie Lynn Maglietta** plans to join a Habitat for Humanity group and work in impoverished villages. She hopes one day to be a travel reporter for CNN or the National Geographic Channel. In her free time, Jamie enjoys singing opera.*

For more information about the various archaeological expeditions offered by Earthwatch: 3 Clock Tower Place, Suite 100, Box 75, Maynard, MA 01754; (800) 776-0188; info@earthwatch.org; www.earthwatch.org

Piltdown Man–continued from page 17

actually handle the fossils; even access to plaster casts was rarely permitted). They also fervently believed that intelligent, thoughtful beings could not have evolved in places like Africa or Asia. Man must have originated in Western Europe; if it were England, so much the better. And there, built to order, was Piltdown Man—ancient, big-brained, and an Englishman, complete with an elephant bone cricket bat.

No field of study, including anthropology and archaeology, is immune to jealousy, prejudice, or plain bad thinking. The hoax occurred at a time when the western world was eager to believe what Piltdown Man seemed to say. We know now that human beings did indeed emerge in Africa, and that the pattern of human evolution is more like a tree than a linked chain, with some branches leading to extinction, some evolving into other branches. But while in the end Piltdown Man may have taught us nothing about human evolution, he remains a powerful lesson on the complexities of human nature.

Selected Resources on Piltdown Man

Lucy: the Beginnings of Human Kind by Donald Johanson and Maitland Edey (Simon and Schuster, 1981). *An excellent resource on the hunt for early man. Gives a clear overview of the Piltdown Man hoax in a historical and scientific context.*

The Piltdown Plot Web site
www.clarku.edu/~piltdown
An exhaustive collection of contemporary and recent accounts of Piltdown Man, including the entire text of The Piltdown Inquest by Charles Blinderman, a step-by-step investigation into the hoax and major suspects.

More About... Mitochondrial DNA

Mitochondria are the only cellular organelle that have their own DNA. And unlike somatic DNA, which is inherited from both parents, mitochondrial DNA is inherited only from the mother, from her egg; the father's short-lived sperm cells contain no mitochondria. This unusual pattern of inheritance makes mitochondrial DNA a unique genetic marker of the maternal line. In contrast, Y-chromosome DNA is passed only along the paternal line. With these two kinds of DNA, geneticists now have the remarkable opportunity to track these complementary lineages through human history.

Solution to Word Wise

I	N	C	A	■	D	E	E	R	■	S	C	A	R	S
N	E	A	R	■	N	I	L	E	■	T	O	R	A	H
D	A	R	T	■	A	N	K	A	■	R	E	E	V	E
U	T	T	I	■	■	■	■	D	E	A	D	S	E	A
S	H	A	F	T	S	■	S	E	M	I	■	■	■	■
■	■	■	A	O	L	■	C	R	I	T	■	L	U	G
■	S	A	C	R	E	■	R	■	■	■	■	E	G	O
■	M	I	T	O	C	H	O	N	D	R	I	A	L	■
S	I	N	■	■	■	■	L	■	R	U	D	D	Y	■
S	T	U	■	S	E	A	L	■	O	N	E	■	■	■
■	■	■	T	O	N	S	■	P	E	O	P	L	E	■
S	T	A	Y	I	N	G	■	■	■	■	G	R	I	M
T	I	K	A	L	■	K	A	T	E	■	R	I	M	E
A	T	I	L	T	■	O	D	I	N	■	A	M	O	N
B	O	N	E	S	■	R	O	M	E	■	M	E	N	D

Planning Ahead for College

by Linda E. Brody, Ed.D.

Picture yourself in college. You're excited, you're happy—but nervous, too. You got into the college you wanted, now to make it work. So much is new. Different from high school. You want to fit in, to make good grades, to impress your teachers. To make college the experience you always hoped it would be.

No matter how excited you are about going to college, it is likely to be a big adjustment. You will need to be much more independent and self-reliant than you needed to be in high school. Strong academic preparedness, good study skills, and well-developed interpersonal skills will be critical to your success at a selective college or university.

Academic Preparation

College courses will focus more on content than on developing skills so hone your writing, math, and computer skills in high school. You will also need a strong content background to do well in more advanced courses.

Writing The ability to write strong, coherent, well-organized essays is critical in college. Good spelling and grammatical skills are also important. If writing doesn't come easily to you, now is the time to get tutorial help. Also develop your word processing skills, an important tool for any student today.

Mathematics You may think you don't need math for your chosen major, but more fields have quantitative aspects than you might think (e.g, psychology, sociology, business). Most colleges also have a math/science course requirement for all students. So leave high school with as strong a background in mathematics as possible in preparation for any requirements that lie ahead.

Computer Skills All students need computer skills for word processing, and to be able to utilize library resources, use the Internet, and access software. You'll also want to use email to keep in touch with friends.

Advanced Courses Studies have shown that students who do well in advanced high school courses also do well in college. So don't avoid the tough courses just because you might not get an A. The experience of tackling rigorous high school courses will give you the discipline and background that college requires.

Prerequisites In choosing high school courses, also consider the specific requirements for your major field of interest. If you plan to major in English, AP Physics may not be critical. But a physics major will not want to be one of the few students in a college physics class who did not take AP Physics in high school. If your high school doesn't offer it, find the equivalent elsewhere or study the topics on your own.

Study and Research Skills

You will need much better study skills than you needed in high school to handle the independent nature of college work and the volume of work required. Many assignments are long-term and require research.

Research Skills Learn how to use a library for research before you go to college—it will be enough of a challenge learning your way around a new library without it also being your first research experience. Become acquainted with databases that search references and learn how to find journals. Use the Internet as a research tool. Build the skills necessary to research material for a term paper of considerable length.

Organizational Aids In college, you will be much more responsible for managing your time and dealing with long-term assignments. If organization is not your strength, learn to use the tools that can make you more organized. For example, use a calendar with appointments and assignments clearly listed; keep a neat notebook; organize your materials in a file cabinet.

Study Skills Students who learn easily often don't have to study very hard to do well in high school so their study skills can be weak when they enter college. Taking tougher high school courses can help, but, if necessary, challenge yourself by studying to learn more than the minimum required. Learn to read for main ideas and take notes on what you read, and take notes in class.

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Perfectionism Researchers have distinguished between "healthy" and "unhealthy" perfectionism. The former is important to college success; the latter is detrimental to it. Healthy perfectionism means striving to do your best, making the extra effort to do a really good job of whatever is required. But perfectionism turns unhealthy when you feel that nothing is good enough, when fear of not being perfect turns into procrastination, and when you get depressed over a poor grade instead of moving on to the next challenge. Examine your study habits with regard to perfectionism. Should you be working harder? Or should you be letting go sooner? Get this under control before the challenge of college makes it worse.

Interpersonal Skills

Few people go to college with their high school friends, and even if you do, you'll want to build relationships with new people. Don't wait until college to evaluate your interpersonal skills.

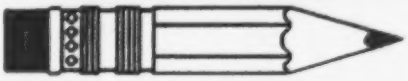
Social Skills To adjust well to college life, it will be important to feel at ease in social situations, to get along with your roommate, to make close friends in a short amount of time. If you're naturally shy or introverted, work on your social skills before going to college. (See *Imagine*, volume 6, no.1 for advice about developing social skills.)

Assertiveness It will be important not only to know how to approach peers, but also to be comfortable approaching your professors and asking for what you need from the college administration. Self-confidence and assertiveness are important traits to cultivate now. Leadership skills gained through extracurricular activities in high school help develop these attributes.

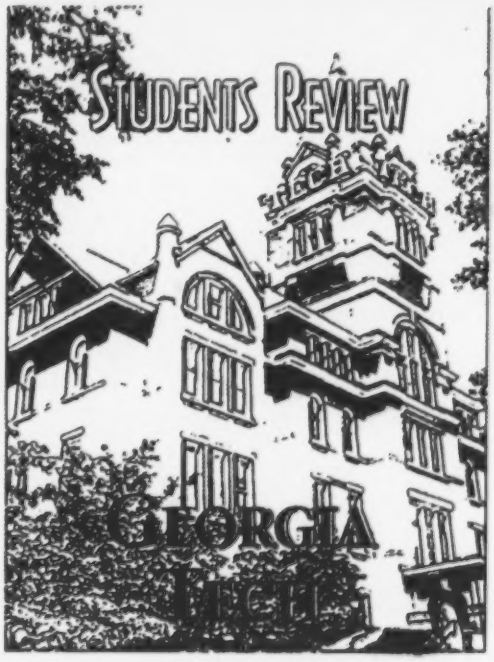
So maybe you've dreamed all your life of the prestige of going to Harvard. Or of the stimulation you would get at Caltech. Or of going to your parents' alma mater. Such dreams give you goals to strive for. But teens who focus on résumé building for its own sake risk arriving at their dream school ill-prepared to be truly successful and happy once they get there. Don't let that happen to you. Focus now on learning and growing and being fully prepared for college.

Mark Your Calendar...

with these December–February registration deadlines for selected academic competitions. Inquire about competition format, dates, and fees.



Fall	**National Spelling Bee—** Local sponsors determine specific deadlines. Students enter only through a sponsoring newspaper; ask your local press if they participate, or contact the spelling bee to find your local sponsor: Scripps Howard National Spelling Bee, P.O. Box 371541, Pittsburgh, PA 15251-7541; (513) 977-3040; bee@scripps.com; www.spellingbee.com/
November 1/ December 15	**MATHCOUNTS—** Schools register 7th and 8th graders; participants compete in chapter meets; state contests in March: MATHCOUNTS Foundation, 1420 King Street, Alexandria, VA 22314; (703) 684-2828; mathcounts@nspe.org; www.mathcounts.org
November 29	**Intel Science Talent Search—** Individual students enter original projects, grade 12 only. Applications available now: Intel Science Talent Search c/o Science Service, Inc., 1719 N Street, NW, Washington, DC 20036; (202) 785-2255; sciedu@sciserv.org; www.sciserv.org
December/ January	**JETS-TEAMS Competition—** Schools register teams, grades 9–12; call for exact state deadlines: Junior Engineering Technical Society, 1420 King Street, Suite 405, Alexandria, VA 22314-2794; (703) 548-5387; jets@nae.edu; www.asee.org/jets
December 20/ January 20	**American Mathematics Contests (AMC->10 & AMC->12, formerly AHSME)—** First qualifying round for the USA Mathematical Olympiad; schools register, grades 9–12; lower fee for earlier date; exam date is Tuesday, February 13, 2001: Titu Andreescu, Director, American Mathematics Competitions, University of Nebraska-Lincoln, Lincoln, NE 68588-0658; (402) 472-6566; titu@amc.unl.edu; www.unl.edu/amc/
January 10	**National Latin Exam—** Latin teachers register students in Intro Latin–Latin 5; Exam given in March: ACL/NCJL, National Latin Exam, P.O. Box 95, Mount Vernon, VA 22121; (703) 360-4354; www.vroma.org/~nle/
January 11	**National Physics Olympiad—** Students submit application to high school physics teacher or counselor to be nominated to take qualifying exam: AAPT, One Physics Ellipse, College Park, MD 20740-3845; (301) 209-3300; mkhoury@aapt.org; www.aapt.org/olympiad/ (See article about this contest on page 34.)
January 15	**National Mythology Exam—** Schools register students in grades 5–9: American Classical League, Miami University, Oxford, OH 45056; (513) 529-7741; www.mythologyexam.org/
Early February	**U.S. National Chemistry Olympiad—** Teachers nominate students who have taken high school chemistry, call for local test dates: American Chemical Society, Education Division, 1155 16th Street NW, Washington, DC 20036; (202) 872-4600; www.acs.org/education/studprog/olympiad.html



The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 20 students, who major(ed) in aerospace engineering (1), applied mathematics (1), architecture (1), chemical engineering (3), civil engineering (2), computer engineering (1), computer science (2), electrical engineering (2), industrial engineering (7), mechanical engineering (1), and systems engineering (2). (The number of majors exceeds 20 because three students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

Georgia Tech offers majors in engineering, math, science, business, and architecture. Reviewers praised the quality of Georgia Tech's education, especially the way course work is related to the "real world." They also noted that Tech does not have grade inflation.

"Outstanding academics are the norm at Georgia Tech. The professors are top-notch. Most are world-class researchers in their areas of expertise, and they often relate their own findings to the material we are covering in class. They also bring in people from industry to explain how what we are learning in school applies to their work."

"The strong core curriculum is focused on helping students build problem-solving skills. Class size can be large (200+) for the lecture sections of core courses during the first two years, but is very small (often less than 10) for upper-level courses. The core classes can be rather impersonal, but most people don't seem to mind. And the impersonality is offset by the fact that all large classes have small recitation sections taught by graduate students. Help is also readily available and fairly easy to track down. In the freshman dorms, for example, there are tutors in the study lounge every night from 6 p.m. to midnight for students who need help in any of their classes."

"Faculty are highly intelligent and know their material backwards and forwards. They are conscientious, willing to help students, and usually great to work with and for. The curriculum is comprehensive and prepares graduates well for the working world. The classes are based on realistic requirements of the workplace and provoke the work ethic and creativity required to succeed. The curriculum builds on itself, assuring that students have the prerequisite knowledge for advanced courses. Upper-level courses are all taught by professors, which is a fantastic opportunity for the dedicated student and one not matched by many institutions."

"A real sense of camaraderie develops among the architecture students because you spend so much time together working all night in the studio! At the time it seemed like living hell, but looking back, it was fun in a twisted way. Free tutoring is available. This saved my neck!"

"Tech offers a five-year Cooperative Education Program in which students alternate semesters of full-time study with semesters of full-time work. All the co-ops I know really enjoy the program. It's a bit odd, going to school only every other semester; but it's nice to get a break from studying, and the experience certainly makes students more prepared for the real world."

"The best things about Tech's instruction are the high intellectual standards that all students are held to and the practical applications that always accompany a lesson. Grading is fair, but tends to fall on the harsh side. The informal class names reflect this: for example, 'Re-mag' is the nickname of the commonly retaken Physics II electromagnetism course."

"Grading is tough. You will quickly loose that 4.0 at Tech. But this is not necessarily a bad thing. You leave each class knowing that you earned the grade you received. Despite the fact that courses are graded on a curve, students are very willing to help one another."

Social Life

Reviewers praised Tech's friendly, active campus life.

"Great! For an engineering school, the place is a lot of fun. There are almost 200 clubs and organizations, with everything from water skiing to improv comedy to service organizations to academic honor societies. Intramurals are big and bring the campus together. Watching sports is another popular activity, since the Tech football and basketball teams are usually pretty competitive."

"The people are extremely friendly. Sometimes it takes me an hour to walk home from class because of the number of people I stop to talk with. The student body is small compared to those of many other universities, which adds to the friendly 'small-town' feel; students know many of their classmates. The campus itself has a welcoming, suburban feel; there are so many trees that it doesn't even look like you're in the city."

"All freshmen live together in one area of campus, which promotes a sense of community from day one. A program called 'The Freshmen Experience' helps students transition into college life by providing a host of educational, cultural, and social events. My group went skydiving, rafting, caving, and wall climbing. All freshmen must also take an Adjustment to College course, which teaches time management skills (essential for survival here!) and the value of differences among people. Tolerance is important because the student body is quite diverse, with students from all over the country and 12 percent coming from outside the U.S."

"Tech has a very tight-knit social structure. Much of the social life centers

around the freshman dorms and the fraternities and sororities. The Greek system is large and well developed, and there is a fraternity for everyone at Tech, not just what you might think of as the 'fraternity type.' The Greek system and other social organizations offer students excellent opportunities to release pent-up energy after spending hours studying. But parties happen only on Friday and Saturday nights, not throughout the week, as students are (almost) all very focused on their studies."

"Atlanta is, in my opinion, one of the best cities in the U.S. It has an active night life, with enough restaurants, clubs, arcades, and theaters to keep anyone busy. There may not be a party on campus every night, but the city takes up the slack, offering everything from opera to hard-rock concerts."

"The 3:1 male-to-female ratio does not mean that if you are male you will never find a date, but it does mean that, since this is the South, you will have to do the asking. Housing is tight but good, especially for upperclassmen. Tech was the site of the 1996 Olympic Village, and the dorms that were built for the Olympics are the best ones to snag."

What Do You Like Best about Georgia Tech?

"The immense rigor of the education. If you get a degree from Georgia Tech you will be thoroughly trained and ready for the real world. I also had a large cadre of very intelligent, interesting friends. Tech combines the scholastic rigor of a small, private school with the fun of being at a mid-sized public school, with Division I football and basketball teams."

"Georgia Tech has an extremely close sense of family. Students have an infectious sense of pride about the school. The fact that Tech isn't a huge school means that all students have an opportunity to shine. Also, the alumni are phenomenal. They have made a positive impact around the globe, and they love Tech. They are strong supporters of the school and a valuable professional network for recent graduates."

"Tech installed a 'no-fear' attitude in me. I also appreciate the respect I get in the real world because of Tech's strong reputation."

What Do You Like Least about Georgia Tech?

Most reviewers mentioned the limitations that a highly structured technical curriculum inevitably places upon students.

"There is little time for free electives. And in some fields, especially fine arts, there are no courses to take even if you have the time."

"The academic rigor minimized the time I spent with students outside my major. During my final two years, the only people I spent time with seemed to be my roommates and my fellow majors."

Georgia Institute of Technology

Atlanta, GA 30332
(404) 894-4154

- 4-year state-assisted coed university
- Urban campus
- Full-time undergraduate enrollment 2000-01: 7,668 men; 3,076 women.
- Special features: The largest optional educational co-op program in the country. Merit-based Presidential Scholarships.

"I wish Tech had more of a geeky tradition. The introverted population is a bit small for my taste. Small enclaves of Animé nerds, computer geeks, and other outcasts can be found, but the majority of students seem to be more sociable. The Bible Belt takes some getting used to, too."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Georgia Tech?

"Someone who is disciplined, enthusiastically academic, community-oriented, and very level-headed. Someone looking for opportunities to learn not only about science, technology, and engineering, but also about how that knowledge applies to the real world."

"Someone who is looking for strong academics and wants to be surrounded by driven peers. Someone who has a good sense of who they are and is looking to explore their limits. An assertive, persistent student will thrive here, and a timid one will be nurtured."

"Artistic types need not apply. That is perhaps an overstatement, but there are really no outlets for people of a truly artistic bent. Art, music, and film courses are pretty nonexistent. On the other hand, I can't imagine a better school for people of a technical or scientific bent."

If You Had It to Do Over Again, Would You Go to Georgia Tech?

Eighteen reviewers enthusiastically said yes, one was unsure, and one said no.

"Definitely! (Actually, I did. I'm now a Ph.D. student here.) The school is top-ranked in engineering, very affordable, in a fun location and on an active, friendly campus."

"Absolutely. It was the best five years of my life, and my degree continues to open doors for me. I have felt very well prepared in my professional life."

"Oh yes. For me, the choice finally came down to Georgia Tech versus MIT. Tech offered me a scholarship, which cut my tuition down to in-state, and the place was so friendly and full of spirit. MIT, on the other hand, looked gray and wintry the day I visited. I went with my gut and have never regretted my decision."

"No. While I would again choose mathematics as my major, I think a school with more to offer in the arts might have suited me better. Nevertheless, I value my time at Georgia Tech highly, had a great time there, and would not hesitate to recommend it to anyone interested in science, engineering, or computers."

As you try to find the college or university best suited to you, the views presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different school. At any college, it is important to seek out challenging academic experiences and to create a social life that fits your personal style.

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

THE COACH'S CORNER

Imagine Yourself on the 2001 U.S. Physics Team

by Mary Mogge

You've always enjoyed studying physics and the intellectual challenge of solving physics problems, so you wonder if you would be a strong candidate for the U.S. Physics Team. The answer may be yes if:

- You've taken AP Calculus and are currently taking or have finished AP Physics C.
- You've taken advanced physics courses at your local university or on the Web.
- You haven't taken a formal physics course yet but have studied the subject extensively on your own.

If any of these sound like you, you should consider applying. The first step is to give the nomination form (which you may have received in the mail, or which you can request—see below) to your physics teacher or counselor. In late January, your teacher will receive the first screening exam, which consists of two parts. You will have 40 minutes for the 30-question multiple choice test, which covers all areas of introductory physics, and 60 minutes for the four free-response questions selected from introductory mechanics. The problems are similar to the preliminary exam problem shown at the end of this article.

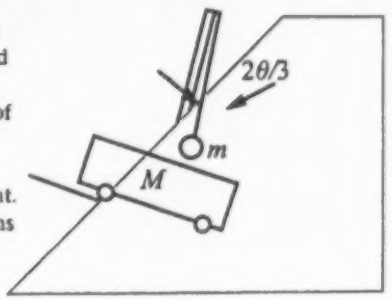
That screening exam narrows the field to 175 semifinalists for the U.S. Physics Team. If you are among them, your teacher will be notified, and you will then take the second screening exam. One 90-minute part of this semifinal exam consists of four free-response questions, similar to the second problem at the end of this article. The other 90-minute part consists of two more difficult free-response questions. Most questions are from mechanics and electricity & magnetism, but there are usually one or two questions from other areas, such as waves, thermodynamics, or modern physics.

The results of that exam determine the 24 members of the 2001 U.S. Physics Team, who are invited to the training camp at the University of Maryland in May. As one of those team members, you would study physics nine hours a day, with

Continued on page 35

2000 Preliminary Exam Problem.

An accelerometer consists of a ball of mass m attached to one end of a string. The other end of the string is attached to a cart of mass *M*. When the cart rolls down an inclined plane of angle θ with respect to the horizontal, the string makes a constant angle of $2\theta/3$ with respect to the vertical. See diagram at the right. Express your answers to the following in terms of known and given quantities. Assume air resistance is negligible.

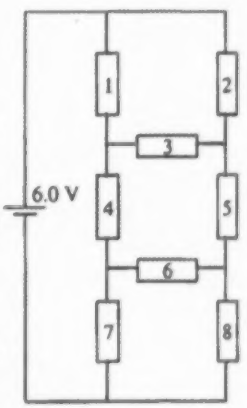


a. What is the acceleration of the cart?

b. What is the coefficient of friction between the cart and the plane?

2000 Semifinal Exam Problem.

The circuit diagrammed at the right consists of a 6.0-V power supply and eight 12.0-Ω resistors, labeled 1 - 8.



a. What is the equivalent resistance of the circuit?

b. What is the current in each resistor? Please use *Ij* to denote the current in resistor *j*.

c. Resistors 1, 5, and 7 are replaced with 4.0-μF capacitors. What is the charge on each capacitor after the circuit has been connected for a very long time? Please use *Qj* to denote the charge on the capacitor in location *j*.

d. The capacitor in location 5 is replaced with a second 6.0-V power supply (positive end closest to resistor 3 and negative end closest to resistor 6). What is the current through each resistor after the circuit has been connected for a very long time? Please use *Ij* to denote the current in resistor *j*. In this part 2, 3, 4, 6, and 8 denote 12.0-Ω resistors, 1 and 7 denote 4.0-μF capacitors, and 5 denotes a 6.0-V power supply.

Answers: 1.a. $2g \sin(\theta/3)$ b. $\tan(\theta/3)$ 2.a. 18 Ω b. All currents either 0 or 1/6 A. c. 9.6 μC, 14.4 μC, 9.6 μC d. All currents either 0 or 1/6 A.

Dr. Mary Mogge is a professor of physics at California State Polytechnic University, Pomona. She has been a coach of the US Physics Team since 1995 and academic director since 1999. She can be reached at memogge@csupomona.edu.

Creative Minds Imagine

The Mango Tree

by Lakshmi Nambiar

I wrapped my arms around the strong, scented bark. I stroked the tough wood and reached inside the deep hole that would no longer serve as a spacious home for the woodpecker. And then I saw them approaching: the people who would take nature away from me. It was my grandfather and four men. The men's hands were filled with yards and yards of rope, and one man held the weapon: a gleaming metal saw. It was ready to sink its sharpened teeth into my beloved mango tree.

My grandfather pointed in my direction, and a smile spread across the face of the man with the saw. It was certainly the biggest tree he had ever seen, and he knew the high market value the wood would fetch. He didn't say this but I read the greed in his eyes. My grandfather was solemn. This tree had been here, flowering with fruit, even before he was born. It was a part of his childhood, my mother's childhood ... *my childhood*, I thought with a sigh.

"Get away, kid," said the man with the saw. "We've got a lot of work to do. God, she sure is a monster. Probably a hundred years old."

"Yeah. What do you think she'll bring in? Maybe 1,000 rupees," said the man with the ropes.

My grandfather remained silent. He scooped me up in his arms and took me back to the house. But I scrambled out of his arms. I started pulling at his shirt and whimpering.

"Why are you letting them take it? I love my tree!" I cried desperately.

"You know why," my grandfather whispered gently. "If you can't stay out here and behave properly, go back in the house."

"I'm going to stay and watch them!" I exclaimed boldly. "She is my tree and she will be lonely without me!"

The neighbors were coming. They enjoyed a spectacle, and the tree cutting would be a good event. Their eyes glowed with excitement as the men sawed the tree and as it fell down with a huge thud upon the ground. They had already forgotten the baskets and baskets of mangos the tree had produced every year. They had already forgotten the gentle shade the tree had given them while the hot sun had beat down on their backs.

Once the men had dragged the tree to the marketplace and the neighbors had returned home to tell their children of the day's events, I climbed onto the tree stump and attempted to count the rings. But there were so many that I eventually lost track, and besides, I didn't feel like counting rings. I felt like crying. And the tears did come, burning my eyes and dropping down on the freshly cut wood.

I looked over my shoulder and saw my broken swing laying in the dust. The men had ripped the swing from the branches. They didn't care. All they cared about was money.

That's all anyone ever cared about. My 10-year-old mind tried to grasp this realization. My grandfather was like the men, too. He didn't love the tree; he loved money. Why else would he let them take the tree, the tree that was a part of him?

The mango tree had given me so much more than mangos. It was what tied me to my homeland. I didn't always enjoy going to India with its sweltering heat, dirty, crowded streets, and poverty that stared me right in the face. But the sweet mango tree was different. It was an escape. It always beckoned me back with its strong branches and enticed me with its golden fruit. The tree was my link to nature.

But money had taken it all away.

***Lakshmi Nambiar** is a junior at East Brunswick High School in New Jersey. She is active in Model United Nations, the Mock Trial team, and the French Honor Society. She has attended CTY for two years. She wrote "The Mango Tree" based upon a visit to India a few years ago.*

Coach's Corner—continued from page 34

almost every day including an exam, a lab, a problem set, and a tutorial on either modern physics, special relativity, waves, or thermodynamics. You'd hear guest lecturers talking about their current research. You'd learn a lot of new physics and solve a lot of challenging problems. And you'd meet 23 of your peers—the brightest high school physics students in the U.S.

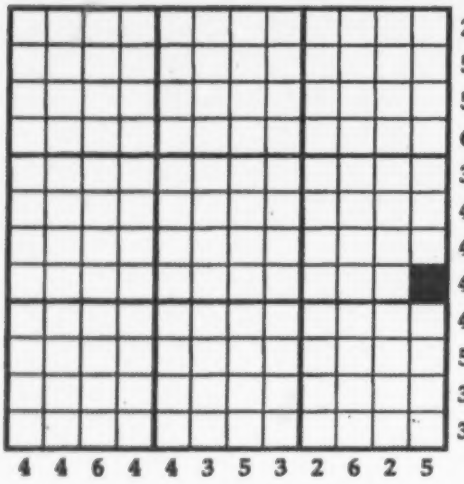
At the end of the training camp, five team members are selected to represent the U.S. Physics Team at the International Physics Olympiad. The next competition will be held June 28 through July 7, 2001, in Antalya, Turkey. Will you be there?

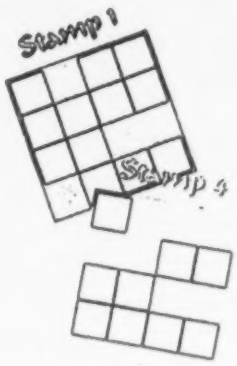
Visit www.aapt.org/olympiad/ to learn more about the U.S. Physics Team, or go to www. psrc-online.org/evaluation/evaluation.html to access past screening exams. Visit members.nbci.com/links2ipho/ for links to information about the International Physics Olympiad.

Contact Maria Elena Khoury at mkhoury@aapt.org or call (301) 209-3344 if you would like an application. The application deadline is January 11.

Knossos Games

by Tim Boester

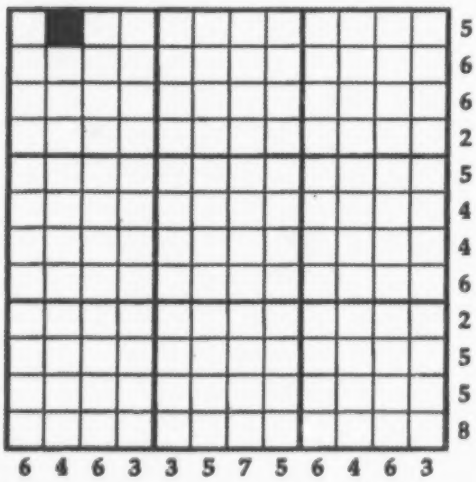


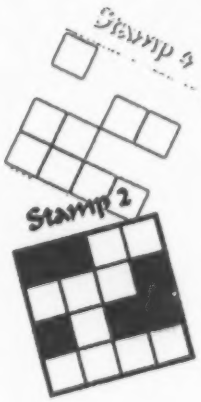


Directions:

Use the two 4x4 stamps at right to fill in the squares of the larger grid. Each stamp may be rotated 90, 180, and 270 degrees. When the grid is correctly filled in, the total number of black squares in a row or column will equal the number found beside or below that row or column.

The squares that are already filled in are hints to get you started; they must be black in the completed puzzle.





Solution to Knossos Games in our September/October issue:

The last person remaining was Eutaw.

The entire sequence of departures is: Preston, Mary, Franklin, Madison, Chase, Tiffany, Paul, Howard, Holliday, Russel, Clay, Pearl, Chuck, Emory, Bill, Eutaw.

A graduate student in educational psychology at the University of Wisconsin, Tim Boester now has additional puzzles on his home page: homepage.mac.com/boester

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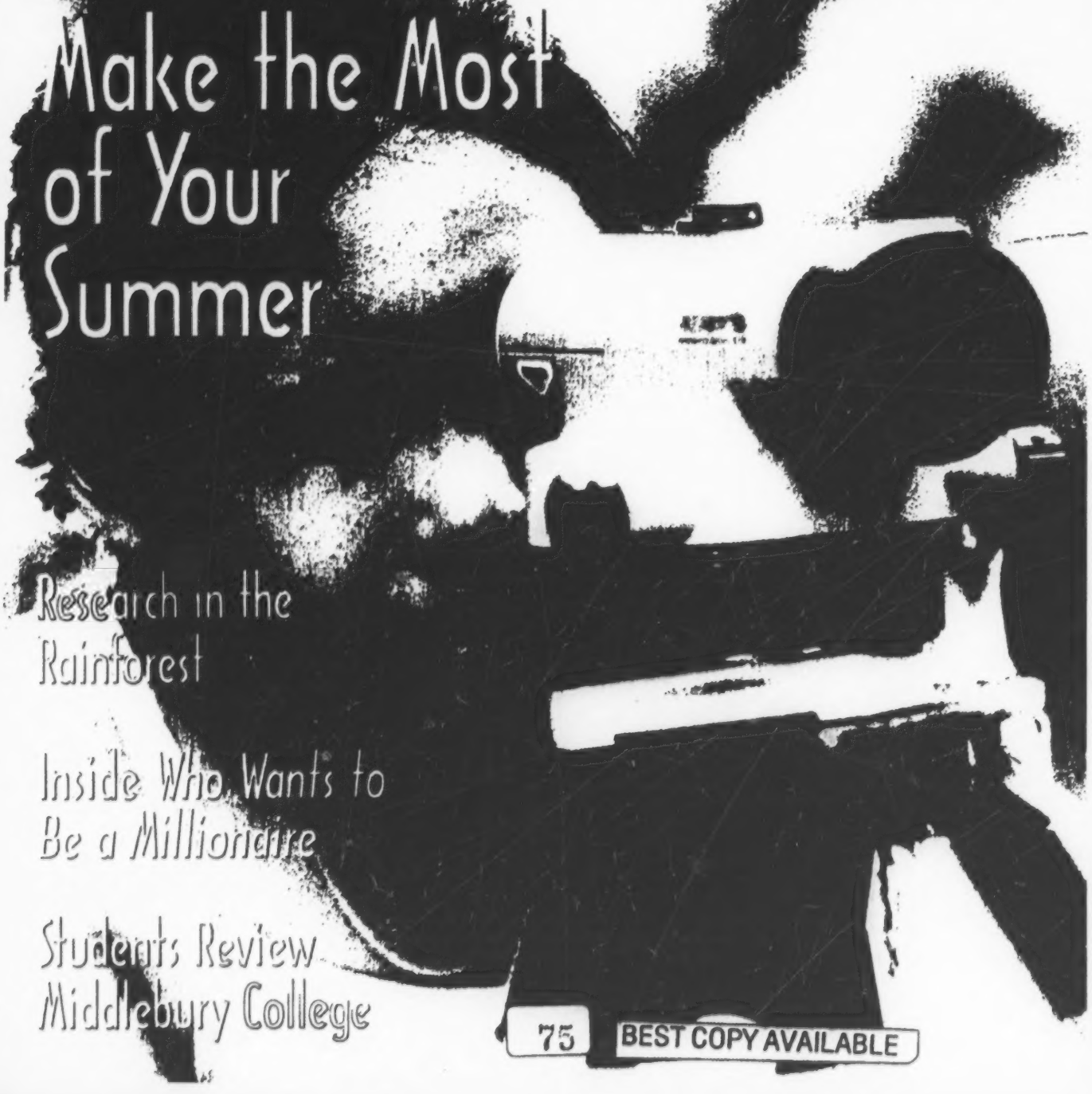
ImaGiNe...

Published by the Johns Hopkins University Center for Talented Youth

OPPORTUNITIES AND RESOU... ACADEMICALLY TALENTED YOUTH

Volume 8, Number 3 • ...February 2001

Make the Most of Your Summer



Research in the Rainforest

Inside Who Wants to Be a Millionaire

Students Review Middlebury College

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ImaGiNe...

Opportunities and Resources for Academically Talented Youth®

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UNIVERSITY

Center for Talented Youth

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Editor • Melissa E. Hartman
Assistant Editor • Michelle Burkhart
SET Director • Linda E. Brody, Ed.D.
Research Associate • Carol C. Blackburn, Ph.D.
Editorial Assistant • Vicki Moore
Student Assistant • Aaron Back
Designer • Delta Graphics & Communications

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Imagine
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(215) 826-0707 • fax: (215) 788-6887

Address editorial correspondence to:
Melissa E. Hartman
SET/CTY
The Johns Hopkins University
3400 North Charles Street
Baltimore, Maryland 21218
(410) 516-0309 • fax: (410) 516-0108
email: mhartman@jhu.edu

Web site: www.jhu.edu/gifted/imagine

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What are you doing this summer?

At the end of May, this question will ring in school hallways all over the country. So why are we asking you now? It's the middle of winter, after all. You haven't even finished the school year, much less planned your summer.

Those three months are a wide open opportunity—to dig into Shakespeare or physics or C++, to visit another part of the world, to make a difference in your community, to do some research, to tour colleges. But to make the most of them, to accomplish all that you want to do, you need to start planning now.

To make the most of those three months, to accomplish all that you want to do, you need to start planning now.

Deadlines for many academic, arts, and international summer programs are rapidly approaching. Many accept students on a first-come, first-served basis and fill their slots long before the end of the school year. The same is true for competitive internships. It is especially crucial to start planning if you want to participate in a few programs—if, for example, you want to nurture both the violinist and the chemist in you.

This issue of *Imagine* was created to help you think about how to make the most of your summer. You'll find listings of some of the most exciting opportunities available, from international research programs and math camps to language immersion programs and writing workshops. And you'll hear from students who have participated in some of these programs as well as valuable internships, volunteerships, and summer jobs. What was it like to study frogs in Costa Rica, or to create an award-winning movie? How challenging was it to dance for eight hours a day, or to set up a program to feed the needy? As these writers make clear, summer is a great time to learn, to follow your passions, to grow.

So, what will you be doing this summer? You just might discover your answer in the following pages.

Correction: Maria Saltzberg's name was printed incorrectly in our September/October issue ("That Sounds Like a Fish Story: Volunteering at the Ocean Discovery Center"). We regret the error.

Visit our Web site at www.jhu.edu/gifted/imagine

AMONG MY PEERS

by Cassandra Wolos

We sat listening to the instructor's Australian accent, engrossed by her explanation of the etymology of the word "Renaissance." I couldn't help but look around the table—who were these other fifth and sixth graders who had chosen to spend the summer studying the intellectuals and inspirations of the sixteenth century? When I signed up for CTY's Young Students Program at Connecticut College, I didn't expect to meet peers from all over the country, even the world, who were equally enthusiastic about a summer of academics.

But there we were, 15 kids from 15 middle schools whose eyes widened eagerly at the sight of the library's stacks and whose brows narrowed in concentration as we explored the ideas of a college text. We created original Petrarchan and Elizabethan sonnets, acted out the archetypes of Italian theater, and completed a formal debate on Machiavelli's famous assertion that "the ends justify the means." Split into groups, we researched the architectural origins of Renaissance design, and for the first time in my life, I felt I wasn't the only productive group member. In fact, the other students' ideas about Brunelleschi's dome helped broaden my perspective.

The social atmosphere at CTY was like nothing I'd ever experienced. At midnight, RA's would snare rebels who dared to keep their lights on (they were staying up to play chess). At the talent show, two boys took the stage: as the audience named the obscure and unknown countries of the world, the first boy would shout out the name of its capital. Then, his friend said the name backwards. I've never heard a crowd enjoy the correct backward pronunciation of Madagascar's capital, Antananarivo, quite so much.

The kids I lived with in a college dormitory that summer and the summers that followed are still my closest friends. We share a passion for knowledge and a perspective on learning that is rarely found among our adolescent friends at home. When my parents phoned that first summer to see if I was all right, they were both shocked and elated to hear me use the word "we." I had met my first real peers.

For the next three years, I returned to CTY's program for older students at Skidmore College. There, I discovered an esoteric culture that arose from the intellectual bonds between us. Although we were a diverse group, the love of learning and the thrill of living among other kids with academic interests brought us all together.

In the classroom, we explored topics that most of us would never have the chance to study in school, with students who understood the material quickly. I took a psychology course taught by a Harvard doctoral candidate and tested out behavioral conditioning on my classmates. The next summer I studied logic from a philosophical perspective and searched for invalid reasoning in *The New York Times*. And the next year, in my Theoretical Computer Science class, I came to understand the inner workings of information processing without touching a computer until the last days of camp.

My positive experiences at CTY motivated me to attend another academic camp. In the summer before eighth grade, after my second summer at CTY, I joined 60 girls my age at Clarkson University in New York to participate in a math and science program designed especially for girls with strong mathematical ability. The one-week camp, called Horizons, introduced me to Web page design, engineering, and career choices for women in math and science. Living and learning in an environment composed only of academically talented girls was both enriching and inspiring. We addressed a wide range of topics, and I embraced science as more than the worksheets I filled out in my middle-school science classes. Despite the amusing fact that the career-guidance test I took suggested "building inspector" as a career to aim for, Horizons helped me to focus my aspirations in the context of math and science.

My academic summers have not been simply a continuation of the school year, as many prospective campers fear. The educational and social experiences these camps gave me have shaped my identity in a unique way: I consider myself an academic, but I know that I don't have to isolate myself to be one. I've learned enough to be a know-it-all, but the peers I've met at academic camps have reminded me that there will always be someone who knows more, adding humility to enrichment. Exploring knowledge among real friends is the best way I can think of to spend a summer.

***Cassandra Wolos** is a junior at Niskayuna High School in Niskayuna, NY. She is the principal trombonist of the Empire State Youth Orchestra and will soon perform with the New York State Conference All-State Symphony Orchestra. She edits the opinion section of her school's weekly newspaper and regularly participates in math and science competitions.*

The Horizons program at Clarkson University recruits girls from upstate New York who excel in science and mathematics. Interested NY girls should contact their guidance offices for more information; Horizons does not accept applications directly from students.

For more information about CTY summer programs, see page 5.

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Selected Academic Summer Programs 2001

Academic challenge doesn't have to end with the school year. Summer can be a time to explore new topics or to concentrate intensively on a subject that you enjoy. No matter where your academic interests lie, there is a summer program for you.

The programs listed on the following pages are among the best available for academically talented students. Space in many summer programs is limited, so we suggest you apply early. You'll want to inquire about qualification requirements, course options, dates, fees, and scholarship availability.

CENTER FOR TALENTED YOUTH SUMMER PROGRAMS

CAA 7th Grade & Above
Grades 7 and up, three weeks, residential sites in CA, MD, PA, and RI.

CTY 7th Grade & Above
Grades 7–10, three weeks, residential and commuter sites in CA, MD, NY, and PA.

CTY Young Students
Grades 2–6, three weeks, commuter sites in

MD, CA, and VA. Grades 5 & 6, three weeks, residential sites in CA, MA, MD, and PA.

CTY Summer Programs, The Johns Hopkins University, Baltimore, MD 21218; (410) 516-0277 or (818) 500-9034; www.jhu.edu/gifted/ctysummer

OTHER REGIONAL TALENT SEARCH PROGRAMS

Center for Talent Development
Grades 4–12, three weeks, residential and commuter. *CTD, Northwestern University, 617 Dartmouth Place, Evanston, IL 60208; (847) 491-3782; ctd@nwu.edu; www.ctd.northwestern.edu*

Duke University Talent Identification Program
(See also page 9.) Grades 7–10, three weeks, residential. *Duke University TIP, Box 90747, Durham, NC 27701; (919) 684-3847; www.tip.duke.edu*

Rocky Mountain Summer Institute
Ages 11–15, two weeks, commuter. Ages 12–16, three weeks, residential and commuter. *Rocky Mountain Talent Search, University of Denver, Wesley Hall, Room 203, 2135 East Wesley Avenue, Denver, CO 80208; (303) 871-2983; www.du.edu/education/ces/si.html*

RELATED PROGRAMS

Like programs offered by the talent searches, the following programs require qualifying exam scores and offer a variety of science, math, and humanities courses.

ADVANCE Program for Young Scholars
Grades 7–11, three weeks, residential. *Programs for the Gifted and Talented, Northwestern State University, P.O. Box 5671, Natchitoches, LA 71497; (800) 259-3173 (within state); (318) 357-4500 (all other areas).*

Selected Academic Summer Programs 2001

Academic Talent Search
Grades 6–9, one to five weeks, commuter. *ATS, California State University-Sacramento, 6000 J Street, Sacramento, CA 95819-6098; (916) 278-7032; http://edweb.csus.edu/projects/ats*

Belin-Blank Center
Grades 7 & 8, Junior Scholars Academy, one week, residential; grades 9–11, National Scholars Academy, and Summer Institute for Creative Engineering and Inventiveness, two weeks, residential. *Belin-Blank International Center for Gifted Education and Talent Development, The University of Iowa, 210 Lindquist Center, Iowa City, IA 52242; (319) 335-6148 or (800) 336-6463; www.uiowa.edu/~belinctr*

Office of Precollegiate Programs for Talented and Gifted
Grades 6–9, one week. Grades 7–11, three weeks. Residential and commuter. *OPPTAG, W172 Lagomarcino Hall, Iowa State University, Ames, IA 50011-3180; (515) 294-1772; www.public.iastate.edu/~opptag_info*

Purdue University Gifted Education Resource Institute
Grades 7–12, two weeks, residential. *Summer Residential Programs, Purdue University GERI, 1446 LAEB, Room 5115, West Lafayette, IN 47907-1446; (765) 494-7243; www.geri.soe.purdue.edu*

Southern Methodist University Gifted Institute and Precollege Programs
Grades 7–9, TAG program, three weeks, residential. Grades 10–11, five weeks, residential and commuter. *SMU/TAG, P.O. Box 750383, Dallas, TX 75275-0383; (214) 768-5437; www.smu.edu/~gsi/*

Summer Institute for the Gifted
Grades 4–11, three weeks, residential. *College Gifted Programs, 120 Littleton Road, Suite 201, Parsippany, NJ 07054-1803; (973) 334-6991; info@cgp-sig.com; www.cgp-sig.com*

University of Southern Mississippi Center for Gifted Studies
Grades 4–8, one week, residential; grades 7–10, three weeks, residential. *Dr. Frances A. Karnes, Director, The Frances A. Karnes Center for Gifted Studies, The University of Southern Mississippi, Box 8207, Hattiesburg, MS 39406-8207; (601) 266-5236; Gifted.Studies@usm.edu; www-dept.usm.edu/~gifted/*

University of Washington Summer Stretch
Grades 7–9, five weeks, commuter. *Halbert Robinson Center for the Study of Capable Youth, University of Washington, Guthry Annex 2, Box 351630, Seattle, WA 98195-1630; (206) 543-4160; http://depts.washington.edu/cscy/ss.htm*

Vanderbilt Program for Talented Youth
Grades 7–10, three weeks, residential. *Petrina Jesz, Program Coordinator, Vanderbilt Program For Talented Youth, Vanderbilt University, GPC 506, Nashville, TN 37203; (615) 322-8261; pty.peabody@vanderbilt.edu; http://peabody.vanderbilt.edu/pty*

Western Kentucky University Center for Gifted Studies
Grades 6–8, two weeks, commuter and residential; grades 7–10, three weeks, residential. *The Center for Gifted Studies, Western Kentucky University, One Big Red Way, Bowling Green, KY 42101-3576; (270) 745-6323; gifted@wku.edu; www.wku.edu/gifted*

Wisconsin Center for Academically Talented Youth
Grades 4–6, one or two weeks, residential. Grades 7–10, three weeks, residential. Grades 11–12, three weeks, residential. *WCATY, 2909 Landmark Place, Madison, WI 53713; (608) 271-1617; www.wcaty.org*

HUMANITIES

Bates College Summer Forensics Institutes
Grades 9–12, one week, residential. *163 Wood Street, Lewiston, ME 04240; (207) 786-6077; summer@bates.edu; www.bates.edu/summer*

Coon Hardy Debate Program
Grades 10–12, four weeks, residential. *Northwestern University NHSI, 617 Noyes Street, Evanston, IL 60208-4165; (800) 662-6474; nhsi@nwu.edu; www.northwestern.edu/nhsi/main/debate/debate.html*

Concordia Language Villages
Ages 7–18, one to four weeks, residential. *Concordia Language Villages, 901 South Eighth Street, Moorhead, MN 56562; (218) 299-4544, (800) 247-1044 (within state) or (800) 222-4750 (out of state); www.cord.edu/dept/clv*

Medill School of Journalism High School Institute
Grades 11 & 12, five weeks, residential. *NHSI Journalism Division, Northwestern University, 617 Noyes Street, Evanston, IL 60208-4165; (800) 662-6474; nhsi@nwu.edu; www.medill.nwu.edu/specialprograms/nhsi/2000/program.html*

Spartan Debate Institute
Grades 9–12, two to three weeks, residential. *William Repko, Michigan State Debate, 10 Linton Hall, Michigan State University, East Lansing, MI 48824; (517) 353-9388; debate@msu.edu; www.msu.edu/~debate*

Stanford National Forensic Institute
Grades 9–12, two to three weeks, residential. *Stanford Debate/SNFI, 555 Bryant St. #599, Palo Alto, CA 94301; (650) 723-9086; snfi@mail.com*

The Young Writers Workshop
Grades 9–12, college credit, three weeks, residential. *Dr. Jamie Hutchinson, Young Writers Workshop, Simon's Rock College of Bard, 84 Alford Road, Gt. Barrington, MA 01230-9702; (413) 528-7231; jamieh@simons-rock.edu; www.simons-rock.edu/academics/summer/summer.html*

MATHEMATICS

Canada/USA Mathcamp
Ages 13–18, five weeks, residential. Rolling admissions. Location varies, year 2001 – Colby College, Waterville, ME. *Mathcamp, 3560 Pine Grove Avenue, Port Huron, MI 48060; (519) 672-7990; www.mathcamp.org*

Hampshire College Summer Studies in Mathematics
Grades 9–11, six weeks, residential. Rolling admissions. *HCSSIM, Hampshire College, Box NS, Amherst, MA 01002; (413) 559-5375; www.hampshire.edu/offices/specprog/hcssim.shtml*

Program in Mathematics for Young Scientists
Grades 9–11, six weeks, residential. Applications accepted March 1–June 1. *PROMYS, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215; (617) 353-2563; http://math.bu.edu/people/promys*

Ross Young Scholars Program
Ages 13–18, eight weeks, residential. *Ross Mathematics Program, Dept. of Mathematics, Ohio State University, 231 W. 18th Avenue, Columbus, OH 43210; (614) 292-1569; www.math.ohio-state.edu/ross/*

Selected Academic Summer Programs 2001

SELECTED PROGRAMS FOR JUNIORS AND SENIORS

Students graduating from the talent search programs can now take advantage of a wide variety of programs aimed at older high school students.

Below is a brief list of some of these programs. If you don't see the college that interests you represented in this list, contact that school directly. Students applying to these programs should be juniors or seniors in Spring 2001 unless otherwise noted.

Brown University Precollege Program
Seven weeks, residential. *Office of Summer Studies, Box T, 133 Waterman Street, Providence, RI 02912; (401) 863-7900; www.brown.edu/Administration/Summer_Studies/mm/index.html*

Carnegie Mellon Precollege Program
Six weeks, residential. Open to sophomores and juniors only. *Carnegie Mellon Precollege, 5000 Forbes Avenue, Pittsburgh, PA 15213; (412) 268-2082; www.cmu.edu/enrollment/pre-college/*

Cornell University Summer College
Two three-week sessions and one six-week session, residential. *Cornell University Summer College Programs, B20 Day Hall, Ithaca, NY 14853-2801; (607) 255-6203; www.sce.cornell.edu/SC/*

Duke University Precollege Program
Six weeks, residential. *TIP Pre-College Programs, 1121 West Main Street, Suite 100, Durham, NC 27701; (919) 684-3847; www.tip.duke.edu*

Harvard Summer School
Eight weeks, residential. *Harvard Summer School, 51 Brattle Street, Cambridge, MA 02138-3722; (617) 495-3192; http://ssp.dce.harvard.edu/*

Johns Hopkins University Precollege Program
Five weeks, residential and commuter. Sophomores may also apply. *Johns Hopkins University, Office of Summer Programs, 102 Macaulay Hall, 3400 N. Charles Street, Baltimore, MD 21218; (800) 548-0548; www.jhu.edu/~sumprog/pc*

Northwestern University College Preparation Program
Six-, seven-, and eight-week sessions, residential. Open to juniors only. *NU Office of Summer Session, 2115 North Campus Drive, Evanston, IL 60208-2650; (800) 346-3768; www.northwestern.edu/collegeprep*

Stanford University Summer College
Eight weeks, residential and commuter. *Summer Session, Stanford University, Building 590, 514 Lasuen Mall, Stanford, CA 94305-3005; (650) 723-3109; http://summersession.stanford.edu/college/*

Yale University Precollege Summer Program
Five weeks, residential. *Yale Summer and Special Programs, 246 Church Street, Suite 101, New Haven, CT 06510-1722; (203) 432-2430; www.yale.edu/summer*

GOVERNOR'S SCHOOLS

Governor's Schools are highly selective programs for academically or artistically talented high school students. These schools, which run for two to six weeks during the summer, vary widely in their course offerings and admissions criteria. For example, some schools require students to be nominated by teachers or administrators, and many of the arts programs require auditions.

Visit the Web site of the National Conference of Governor's Schools at *http://ncogs.mcs.cmu.edu/ncogs/* to learn more about Governor's Schools. If you don't find a link to a school in your state, call either your governor's office or state education agency to find out if your state offers this program.

SELECTED RESOURCES

Educational Opportunity Guide: A Directory of Programs for the Gifted (Duke University TIP, 2000).
To order, contact Duke University Talent Identification Program, P.O. Box 90780, Durham, NC 27708-0780; (919) 683-1400; www.tip.duke.edu

Summer Fun: Travel and International Programs (Peterson's Guides, 2000).

Summer Opportunities for Kids & Teenagers 2001 (Peterson's Guides, 2000).

Yale Daily News Guide to Summer Programs 2001 by Sara Schwebel (Kaplan, 2000).

Research in the Rainforest

by Laura White

We pulled on our cumbersome rubber boots in the dim predawn light to the raucous squawking of a flock of parrots flying overhead. In normal circumstances, I'd have shuddered at the thought of waking up before dawn during summer vacation. But then, these weren't exactly normal circumstances.

Our boots squished softly through the muddy forest trails as I tried to remain quiet, straining my ears for the cricket-like chirp of poison dart frogs. As the sun rose high above the canopy of towering trees, the forest awoke and began to fill with sound. "Ee-ee-ee-ee-ee-ee-ee-ee-" came a call from my left. I moved off the path and went searching for its source, stepping cautiously over logs and around roots after checking to make sure there were no snakes concealed within them. I'd almost given up when I spotted it: a tiny frog, the size of my fingernail, gleaming bright red and blue against a moss-covered tree.

This past summer I had the opportunity to spend three weeks in Costa Rica as part of Duke University's Talent Identification Program summer field studies. The flyer announcing the program had arrived in my mailbox the same week that I had begun reading Darwin's *Voyage of the Beagle*, and the possibility of seeing the tropics for myself had intrigued me. I did a little research of my own on the country, and then started trying to convince my parents to let me go. After weeks of discussion, they finally agreed.

Along with three instructors and fourteen other high school students from Boston, Minnesota, Germany, and everywhere in between, I learned firsthand how to design an ecological study, while staying at four different biological stations in the country. In between hiking up mountains carrying all our gear on our backs, and avoiding poisonous snakes, vicious ants, and absurd amounts of mud, we gained a new respect for the life of a tropical ecologist.

I'd always assumed that biological field research was fairly easy: you'd come up with a hypothesis, decide how to test it, and then go out and see if you could collect data that supported your results. What I found was that, unlike in a laboratory, doing a study in the tropics is not so simple. In many ways, studying a population of frogs in a rainforest is much more complicated than looking at a population of bacteria in a petri dish. Animals and plants are spread farther apart, harder to find, and less likely to be in convenient places. On one particular day, my group waded through the same swamp four different times on our hunt for frogs! Despite all of these challenges, completing our study was still incredibly fun—especially when we were working in such an inspiring atmosphere.

I'd dreamed about being in the rainforest, but I never had any real concept of what it was like until I was there. The forest was more astoundingly beautiful and complex than I'd envisioned, from the tiniest beetles that crawl along the forest floor to the giant, bromeliad-covered trees that loomed over our heads. While locating and counting poison dart frogs and identifying colonies of ants, I saw howler monkeys, butterflies, tree-dwelling anteaters, wild pigs called peccaries that "bark" when frightened, and even a baby coatimundi that showed no fear of humans, walking right up to me as I watched in amazement.

The time I spent in Costa Rica was truly unforgettable. Not only did I learn more about the flora and fauna of the tropics than I'd ever known, but I also got to design and complete three short research studies, brush up on my Spanish skills, and enjoy the thrill of simply being in the tropics. Thanks to my experiences during these three weeks, I'm now not only convinced that I want to be a biology major, but am also looking forward to studying abroad in college.

Laura White is a senior at Centennial High School in Ellicott City, MD. She is currently exploring a very different aspect of biology through her independent research project on genetic privacy. However, she does miss the frogs.

Duke University TIP International Summer Study Trips
Duke University Talent Identification Program, Box 90747, Durham, NC 27708-0747; (919) 684-3847; www.tip.duke.edu
Students in grades 7–10 who earn qualifying scores on the SAT-I may choose from three-week study trips in Costa Rica and several other countries. Call to inquire about 2001 offerings.

Economics students in Beijing

SPEND THIS SU

ACADEMIC PROGRAMS

Want to study Yeats in Ireland or conduct research for the Science Talent Search in Russia? The following opportunities combine the challenge of an academic program with the thrill of experiencing another culture. As with all summer programs, we encourage you to apply early for the international programs that interest you.

American Institute for Foreign Study Precollege Summer Programs
River Plaza, 9 West Broad Street, Stamford, CT, 06902-3788; (800) 727-2437; www.aifs.org
16- and 17-year-old students receive college credit for language or liberal arts courses in 4-to-8-week programs at The American International University in London; the Sorbonne and College International de Cannes in France; the University of Salamanca in Spain; and St. Petersburg State Polytechnic University in Russia.

ARML-China Exchange Program
Mark Saul, President, American Regional Mathematics League, 711 Amsterdam Avenue, New York, NY 10025; (212) 666-5188; msaul@compuserve.com; www.armlmath.org/china.html
High school students spend two weeks in Beijing, where they learn mathematics with Chinese high school students and Olympiad team coaches, and visit historical and cultural sites.

Earthwatch Institute
3 Clock Tower Place, Suite 100, Box 75, Maynard, MA 01754; (800) 776-0188; info@earthwatch.org; www.earthwatch.org
Students ages 16 and older travel abroad as part of a research team investigating topics ranging from Climate Change at the Edge of the Arctic to Zebras of Kenya. Students choose their area of research as well as expedition dates.

Intern Exchange International
Lynn Ann Weinstein, Director, IEI, 130 Harold Road, Woodmere, NY 11598; (516) 374-3939; InternExchange@compuserve.com; www.internexchange.com/index.html
High school students ages 16–18 travel to London for month-long internships in fields including law, medicine, archaeology, digital media, theater, social services, and more.

International Summer Science Institute
Ms. Debbie Calise, American Committee for the Weizmann Institute, 130 E. 59th Street, 10th Floor, New York, NY 10022; (212) 779-2500; debbie@acwis.org; www.weizmann. ac.il/youthact/english/sumin.htm
Twenty graduating seniors from the U.S. join about 60 other outstanding high school students from around the world at the Weizmann campus in Rehovot, Israel, for this four-week summer program that includes lab projects, lectures, and field study.

Irish Centre for Talented Youth
Dr. Sheila Gilheany, Director, CTYI, Dublin City University, Dublin 9, Ireland; 011 353-1-7045634; www.dcu.ie/ctyi/index.html
Students ages 12–16 who have earned qualifying scores on the SAT may apply to take three-week courses on a range of humanities and science topics.

Knowledge Exchange Institute (KEI) Study Abroad Programs
Knowledge Exchange Institute, P.O. Box 332, W. Nyack, NY 10994; (800) 835-5095; cis@knowledgeexchange.org; www.knowledgeexchange.org/studyabroad.htm
High school students choose from three programs: the program at the University of International Business and Economics (China) awards up to four college credits; the two Research Abroad Programs (Russia, Germany) help students prepare for the Intel Science Talent Search, other science contests, and publication, and award four college credits.

Oxbridge Academic Programs
601 Cathedral Parkway 7R, New York, NY 10025- 2186; (800) 828-8349 or (212) 932-3049; info@oxbridgeprograms.com; www.oxbridgeprograms.com
Four-week intensive academic programs for students in grades 10–12 take place at Oxford University, Cambridge University, and the Académie de Paris. Students in grades 8 and 9 attend a four-week program at Cambridge. All programs offer a range of courses in the humanities, sciences, social sciences, and creative arts.

SciTech at The Technion–Israel Institute of Technology
SciTech Coordinator, Center for Pre-University Education, Technion–Israel Institute of Technology, Haifa, 32000, Israel; 972-4-8293034; scitech@tx,technion.ac.il; www.technion.ac.il/~scitech
In this five-week science and technology research camp, students in grades 10–12 from around the world pursue research

The Hermitage, home of Peter the Great, serves as backdrop for lab students sightseeing in St. Petersburg

dying in the gardens of the University of International Business and Economics in Beijing

At the Puschino Science Center in Russia, students conduct research under the mentorship of Russian scientists

AMER ABROAD!

projects of their choice individually or as part of a group.

Tufts Summit
Tufts Summer Programs in the French Alps, 108 Packard Avenue, Medford, MA 02155; (617) 627-3290; france@infonet.tufts.edu; http://ase.tufts.edu/frenchalps/hs.htm
This four-week program combines instruction in international relations and French language and culture for students completing grade 11 or 12 who have had at least two years of high school French.

University of Dallas Summer Study in Europe
Ms. Bea Chityil; Rome and Summer Programs Office; University of Dallas; 1845 East Northgate Drive; Irving, Texas 75062-4736; (972) 721-5181; www.udallas.edu/udtravel
High school students choose from four college courses offered in three different countries: Latin in Rome (3 weeks), Shakespeare in Italy (3 weeks), Thomas More in England (2 weeks), and Churchill in England (2 weeks). College credits awarded.

CULTURAL AND LINGUISTIC IMMERSION PROGRAMS

These programs abroad allow students to focus on people, culture, language, and customs through homestays and travel within the country.

AATG Summer-Study Trip to Germany
German Testing & Awards Program, American Association of Teachers of German, 112 Haddontowne Court #104, Cherry Hill, NJ 08034; (856) 795-5553; headquarters@aatg.org; www.aatg.org/hsstudentprog/summerstudy.htm
Students ages 15–18 spend a month in Germany, where they live in German homes, attend high school classes, and take trips to points of interest. Students who are at least 16 years old, have a B average, and score in the 90th percentile on the National German Exam are eligible for the Study Trip Award, which pays the expenses for the Study Trip, including round-trip airfare.

The American Farm School Greek Summer
Program Coordinator, Greek Summer, American Farm School, 1133 Broadway, Suite 1625, New York, NY 10010-7903; (212) 463-8434; nyoffice@amerfarm.org; www.afs.edu.gr/html/greek_summer.htm
Students who have completed grade 10, 11, or 12 live in a Greek village where they participate in a community service project; they also take several trips to various archaeological and cultural sites of interest.

AFS Summer Exchange Programs
AFS Intercultural Programs, 17th Floor, 71 West 23rd Street, New York, NY 10010-4102; (212) 807-8686; info@afs.org; www.afs.org/usa/Sending/summer.html
For up to seven weeks during the summer, high school students may choose from three levels of homestay programs as well as community service missions in a wide variety of countries.

ASSE International Student Exchange Programs
ASSE USA Headquarters, 228 North Coast Highway, Laguna Beach, CA 92651; (800) 333-3802; www.asse.com [Information for regional offices available on Web site.]
Students ages 15–18 may participate in homestay programs in Japan and Europe (6 weeks each) and in Australia (4 weeks), or in language programs in France, Spain, and Germany (4 weeks each).

Experiment in International Living
Kipling Road, P.O. Box 676, Brattleboro, VT 05302-0676; (802) 257-7751; eil@worldlearning.org; www.worldlearning.org/ip/summer.html
High school students who have completed at least grade 9 participate in challenging cross-cultural experiences living as members of host families in three-, four-, or five-week programs in 19 countries. Some programs require knowledge of the country's native language.

Nacel Open Door Summer Abroad
Nacel Open Door, 3410 Federal Drive, Suite 101, St. Paul, MN 55122; (800) 622-3553; apply@nacelopendoor.org; www.nacelopendoor.org
Students ages 13–18 choose from a variety of 3-to-5-week programs offered in Asia, Australia, Europe, and Latin and South America.

Rassias Summer Language Programs
P.O. Box 5456, Hanover, NH 03755; (603) 643-3007; rassias@sover.net; www.sover.net/~rassias/
Four- and five-week programs in France and Spain include two weeks of language study followed by travel within the country. Students in grades 9–11 who have had two years of French or Spanish are eligible to apply.

Photos courtesy of Knowledge Exchange Institute.

idents see Russian history up close at the Hermitage

The Puschino Science Center in Russia

For the Love of Dance: INTERLOCHEN ARTS CAMP

by Maggie Bergeron

I've always been passionate about dance—it's how I express myself. So it's probably not surprising that even after two years of serious training at Interlochen Arts Academy during the school year, I returned as a summer intern in the Dance Division. As a ballet instructor and student, I learned how valuable a summer program can be for dancers who want to improve their stamina, technique, and artistry, all while becoming a more well-rounded person.

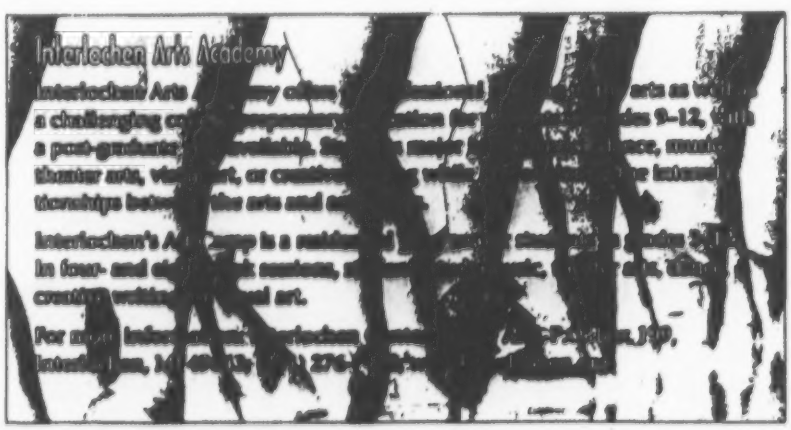
Interlochen's summer dance program is an intensive eight-week program for high school students; junior high students have the option of an eight- or four-week session. We danced from 9:00 a.m. until 5:00 p.m. with only an hour off for lunch. All dance students take a rigorous schedule: ballet and modern dance classes every day and pointe and jazz classes every other day. The variety of classes gives dancers the ability to switch dancing styles easily, a definite asset when looking for a job later in life. And the difficulty of the classes ensures technical improvement: my jumps developed a more obvious *balon*, or bounce, and my turns became less forced.

Classes are demanding, but they are not the only challenge at dance camp: dancers also have a full schedule of rehearsals throughout the day. For example, I was part of the Interlochen Summer Dance Ensemble, which performed *Les Sylphides*, a romantic ballet. After learning the history of the ballet, we had to learn how to develop a character. Sylphs are ghosts, so we worked to make our movements as fluid as possible to communicate an ethereal quality to the audience. *Les Sylphides* also features a lot of corps de ballet work, which requires individual dancers to mesh into one body of movement. In rehearsals and in the final performance, I could see how much we all had grown as artists and technicians.

All this sounds like a lot of work, but dance camp is also a lot of fun. Interlochen is a beautiful wooded area in northern Michigan, and campers go on recreational trips to places such as the Sleeping Bear Dunes. Even on campus, dancers do a lot more than just dance, attending orchestra and band concerts, plays, musicals, and art openings that feature students from Interlochen's other divisions. In fact, dancers interact daily with artists from the other divisions and share cabins with students who may paint or play violin as their major.

Interlochen's summer dance program isn't for everyone. It's intense, and if you aren't passionate about dance, you won't have a good time. But if you love to dance and are willing to work, a summer program like this is an excellent choice. You'll be a different and better person—and dancer—afterwards; I know I was.

Maggie Bergeron is a sophomore at the University of Minnesota, where she is pursuing a degree in dance. She wrote this article in 1998, after her first summer teaching at Interlochen. Maggie has since performed with the Keshet Dance Company, served as Artist in Residence in the Minnesota public school system, and taught another summer at Interlochen. She will teach there again this summer.



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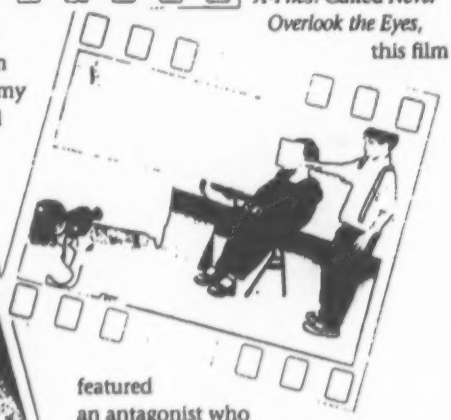
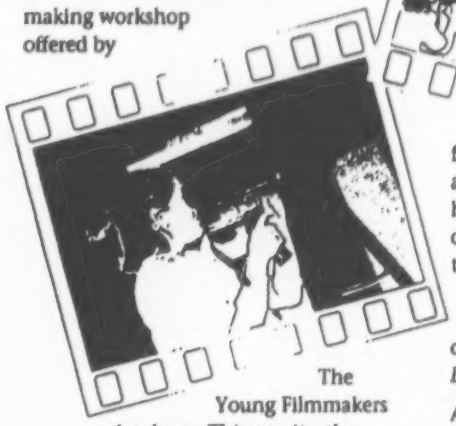
THE MAKING OF A FILMMAKER

by Kathleen Worrell

I have always loved movies. At a young age, I recognized that movies are not only something interesting to watch, but also a unique medium for expressing ideas. For years, I longed to write, produce, and direct films. Listening to music, I could create the video in my head. Reading a book, the scenes from the story all cut perfectly together in my mind. It was like I was already behind the camera.

Then, a few years ago, I found a Web site about a kids' summer filmmaking workshop offered by The Young Filmmakers Academy. This was it—the opportunity I had been waiting for. I eagerly signed up.





Lights, Camera, Action

The first thing I learned at film school was that you can't just get behind the camera. We started by taking acting classes, which I resented. I wanted to direct, not act. But when we began filming the next day, I understood the purpose of the acting lessons: when directing an actor, you need to be able to speak the language and, sometimes, even play the part yourself for a minute to make sure you and the actors understand one another.

When the time finally came to make our own film, my group decided to create a sci-fi film inspired by *The X-Files*. Called *Never Overlook the Eyes*, this film featured an antagonist who has the power to make people faint or die simply by looking into their eyes. At the end of the movie, the main characters, Moldy and Skuller, make him look into a mirror, forcing him to see his own eyes. Viewers are left wondering, *Does his power work on himself?*

After our group's mentor had edited the film and added a soundtrack to it, we got to watch it on a screen with our families and friends. That was when it first hit me: I was now, officially, a filmmaker.

Coming Attraction

I returned the following summer for the intermediate program, which allowed me to build on what I'd learned the year before and get more involved in the film after it had been shot. That year, my group worked on a movie called *Just a Dirty Day*. It started out as another sci-fi/horror film but evolved into what I consider a rather harsh love story. The story involves a girl who, with her touch, can either nearly kill or rejuvenate living things, including a flower and her boyfriend.

It took four of us three days to put this 2-minute, 15-second film together. We created the film from beginning to end, from composing our shot list (which involved whether we should shoot close-ups or wide shots, for example) to editing and deciding on the soundtrack. We watched the film together and talked about which scenes were good and which we had to leave on the cutting room floor. I had always heard that it took thousands of frames to create a few minutes of a movie, but it wasn't until editing *Just a Dirty Day* that I understood why.

Putting in long days to create that short film was more than worth the effort. The executive director of the program entered the film in a competition for

Continued on page 29

30 BY 30: KID FLICKS

HBO Family's *30 by 30: Kid Flicks* showcases 30 films made by kids—including a variety of animation, live action, documentaries, video diaries, and puppets—in a 30-minute show.

The *Kid Flicks* winners are picked on the basis of the following criteria: superior concept or idea; superior camerawork, lighting, and sound; creativity and originality; good use of talent/acting (if used); good editing/special effects (if used); and general effectiveness.

The show airs every day at 4:30 on the HBO Family channel. For more information on *30 by 30: Kid Flicks*, visit their Web site at *www.hbo4kids.com/kidflicks/*

Arts

Are you looking to meet artistic challenges this summer? Would you like to paint in a professional studio? Are you considering playing the violin professionally, but aren't sure if that is truly where your interests lie? Would you like to gain expertise in editing your own videos? Do you wish that there was more time during the academic year for in-depth study of the dramatic arts? If you answered yes to any of these questions, then you may be the perfect candidate for a summer arts program.

American Academy of Dramatic Arts Summer Program
Ages 14 and older, commuter (programs in both New York and California). One six-week session in the dramatic arts including acting, movement, vocal production, and voice and speech.
AADA/East, 120 Madison Avenue, New York, NY 10016; (800) 463-8990 OR AADA Hollywood, 1336 North Brea Avenue, Hollywood, CA 90028; (800) 222-2867; www.aada.org

Boston University Institute for TV, Film, and Radio Production
Ages 14–18, residential. One five-week session in design, directing, film, multimedia, producing, radio, screenwriting, the television field, and television studio. *Institute for TV, Film, and Radio Production, Boston University College of Communication, 640 Commonwealth Avenue, Boston, MA 02215; (617) 353-5015; www.bu.edu/com/itrp*

Boston University Tanglewood Institute
Ages 15–18, residential. Three-, four-, and six-week sessions in composition, harp, orchestra, piano, vocal music, and wind ensemble. Two-week workshops available for various individual instruments. *Boston University Tanglewood Institute, 855 Commonwealth Avenue, Boston, MA 02215; (800) 643-4796; www.bu.edu/sfa/affiliated/buti*

Boston University Theatre Institute
Grades 10–12, residential and commuter. One six-week session in theater including acting, audition technique, directing, movement, playwriting, script analysis, Shakespeare performance, singing, and stage combat. *Meg Wright, Assistant Director, Boston University Theatre Institute, 855 Commonwealth Avenue, Room 470, Boston, MA 02215; (617) 353-3390; www.bu.edu/sfa/affiliated/theatreinstitute/theatre_institute.html*

Bowling Green State University Summer Music Institute
Grades 7–12, residential and commuter. Nine one-week sessions in vocal and instrumental music (including jazz), recording, and musical theater. *College of Musical Arts, Bowling Green State University, Bowling Green, OH 43403; (800) 346-2478; www.bgsu.edu/colleges/music/events/smi.html*

California State Summer School for the Arts
Grades 9–12, residential. Four-week sessions in animation, creative writing, dance, music, theater, video and film, and visual arts. *California State Summer School for the Arts, P.O. Box 1077, Sacramento, CA 95812-1077; (916) 227-9320; www.csssa.org*

Carnegie Mellon University Pre-College Programs in the Fine Arts
Grades 11 and 12, residential and commuter. Six-week sessions in architecture, drama, graphic or industrial design, music, and visual arts. *Pre-College Admission, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213; (412) 268-2082; www.cmu.edu:80/enrollment/pre-college/*

The Center for Creative Youth
Grades 10–12, residential. Five-week sessions in creative writing, dance/movement, filmmaking, music, musical theater, technical theater, theater, and visual arts, which includes photography. *The Center for Creative Youth, Wesleyan University, 350 High Street, Middletown, CT 06459; (860) 685-3307; www.crec.org/ccy*

Choate Rosemary Hall Summer Arts Conservatory Program
Grades 7–12, residential and commuter. Five-week sessions in choral music, orchestra, playwriting, theater, and visual arts. *Choate Rosemary Hall Summer Arts Conservatory Program, Paul Mellon Arts Center, 333 Christian Street, Wallingford, CT 06492; (203) 697-2423 or (203) 697-2488; www.choate.edu/pmac/artsconservatory.html*

Eastman School of Music
Grades 9–12, residential and commuter. One-day to three-week sessions in bass, guitar, harp, voice, chamber music, composition, jazz, music technology, and wind ensemble. Young artists' international piano competitions are also available. *Eastman School of Music, Community Education Division/Summer Session Office, 26 Gibbs Street, Rochester, NY 14604; (800) 246-4706; www.rochester.edu:80/eastman/summersession/ss_highschool.html*

Interlochen Arts Camp
See page 12.

National High School Institute
Grades 9–12 (varies by program), residential. Five-week sessions in dance, journalism, leadership and community, media arts, music, and theater arts. Four-week session in debate available. *NHSI, Northwestern University, 617 Noyes Street, Evanston, IL 60208-4165; (800) 662-NHSI; www.northwestern.edu/nhsi*

New York University Tisch School of the Arts Summer High School Programs
Grades 11 and 12, residential. Four-week sessions in drama, filmmaking, and musical theatre writing. *New York University, Tisch School of the Arts, Summer High School Programs, 721 Broadway, Room 1247, New York, NY 10003-6807; (212) 998-1811; www.nyu.edu/tisch/summer/highschool.html*

North Carolina School of the Arts
Ages 12 and older (varies by program), residential. Five-week sessions in dance, drama, filmmaking, music, and visual arts. Two-week programs available for various individual instruments. *North Carolina School of the Arts, 1533 South Main Street, Winston-Salem, NC 27127; (336) 770-3290; www.ncarts.edu/summer/summer%20session.htm*

Pittsburgh Ballet Theatre's Intensive Summer Program
Ages 12 and older, residential and commuter. One six-week session offering courses in technique, pointe, adagio, variation, character, jazz, modern, mime, and acting. *Pittsburgh Ballet Theatre, 2900 Liberty Avenue, Pittsburgh, PA 15201-1500; (412) 281-0360; www.artsnet.org/pbt/SchoolSummer.htm*

Princeton Ballet School Summer Workshop
Ages 12 and older, residential and commuter. One five-week ballet session offering classes in technique, pointe, variations, partnering, modern dance, theater dance, improvisation, and choreographic workshops. Workshop students are eligible to be chosen for traineeships with the American Repertory Ballet. *Princeton Ballet School, 301 N. Harrison Street, Princeton, NJ 08540; (609) 921-7758; www.arballet.org/summer_training.htm*

Savannah College of Art and Design Rising Star
Grade 12, residential and commuter. One five-week session in building arts, design, performing arts, visual arts, and the history of art and architecture. *Rising Star, Admission Department, The Savannah College of Art and Design, P.O. Box 3146, Savannah, GA 31402-3146; (800) 869-7223; www.scad.edu/flashFILES/main_home/main_homefrms/siteindex.htm (then click on Rising Star)*

Sewanee Summer Music Center
Ages 12 and older, residential. One five-week session in chamber music, composition, conducting, orchestra, and piano. The training sessions are combined with a professional concert series of over 30 performances. *Professor Katherine Lehman (for admissions inquiries) or Dr. Steven Shrader (for all other inquiries), Sewanee Summer Music Center, 735 University Avenue, Sewanee, TN 37383-1000; (931) 598-1225; www.sewanee.edu/ssmc*

The University of the Arts Pre-College Summer Institute
Grades 11 and 12, residential and commuter. Two- to six-week sessions in drama, fine arts, jazz instrumental performance, media and communications, and musical theater. *Pre-College Programs, The University of the Arts, 320 South Broad Street, Philadelphia, PA 19102; (215) 717-6430; www.uarts.edu/newhub.html (click on Continuing Studies and then Pre-College Summer Institute)*

The Young Filmmakers Academy
See page 29.

All photos courtesy of Interlochen Center for the Arts

The Internship Search

by Michelle Burkhart

Summer internships afford the perfect opportunity to gain professional skills, gather insight into a particular field or organization, and establish connections. With so much to gain, you'll want to take the time to look and choose carefully.

Finding an Internship

Before looking for an internship, you need to decide what you want to get out of it. What do you want to learn? Are you looking to investigate career possibilities? Or maybe you just want to learn some career-related skills, such as analyzing data, public speaking, writing articles and reports, or dealing with customers. Maybe you want to work on a specific research project. The opportunities are endless, but you need to set your goals from the start.

Your next step will be to find companies or organizations that may be able to meet your internship goal. You may also want to consider reputable high school internship programs beyond your immediate geographic area. The following resources are excellent places to get started in your search:

- Look at books in your local library or bookstore. *The Internship Bible 2001*, *Peterson's Internships 2001*, *The Yale Daily News Guide to Internships 2000*, and *The Best 106 Internships* are all good places to start.

If you have a specific field in mind, check out the reference section for books such as *The Official Museum Directory*, *The Europa Directory of International Organizations*, *The Nature Directory: A Guide to Environmental Organizations*, *Literary Marketplace*, and *The Encyclopedia of Associations*.

- Surf the Internet to identify potential companies and organizations. Perform searches on internship sites such as
www.campuscareercenter.com
www.internshipprograms.com
www.careerplanit.com/world/internship.cfm
www.idealist.org
www.internweb.com
www.rsinternships.com
www.internjobs.com

- See what resources are available at your high school or local universities. You can also find valuable job search information on many universities' Web sites.

- Use your local phone book to identify opportunities in your community.

- Ask your family members, friends, friends of your parents, parents of your friends, teachers, guidance counselors, gifted education counselors, ministers, and coaches for ideas.

Once you have a list of possibilities, investigate your options. Find out as much as you can about the internship program. Try to schedule an on-site visit to tour the facilities and meet with your potential supervisor. If you can, talk with current interns about their experience.

Getting an Internship

Your dream internship might not be easy to find. So once you find it, make sure you're the strongest candidate you can be. Some internships are quite competitive, and details can make the difference between you and another applicant. The following suggestions might help you gain an edge over other applicants:

- If there is an application packet, make sure it is complete. Provide employers with a brief and accurate résumé as well as a compelling cover letter.

- Have plenty of résumés available at your interview. Your potential employer may want to give your résumé out to numerous departments.

- Dress appropriately for interviews and be on time.

- Make sure you have done some background research on the company or organization and subtly bring things up throughout the interview. For example, "I noticed on your Web site that..." Employers like candidates who have done their homework.

- Let your enthusiasm shine through. If employers are faced with two equally qualified candidates, they will choose the person who showed more interest.

- Always follow up with a written thank-you letter. Thank all interviewers for their time and reaffirm your interest in the internship.

Choosing Your Internship

If you are accepted by several companies or organizations, you will need to decide on the best internship option for you.

The following considerations may be important for you:

- How selective was the application process? Is it likely that you will be presented with this opportunity again?

- How much compensation is offered? Internships generally do not pay well, if at all. However, the emphasis in most internships is on learning, not earning.

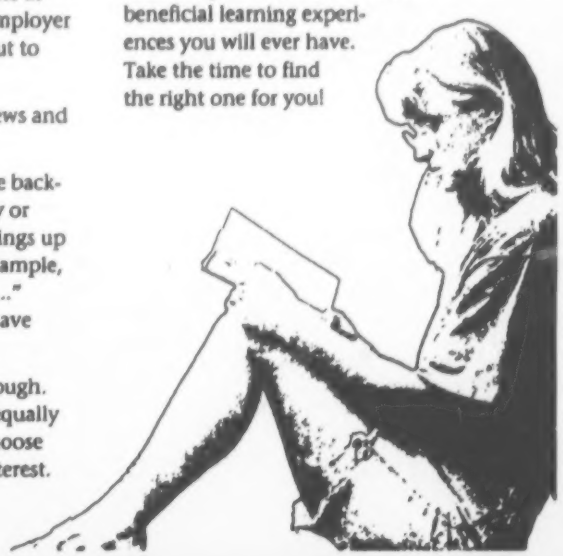
- How much supervision will you have? You may want guidance from a mentor if you want to create a certain product, perform specific research, or learn a particular technique, but don't know how to go about it.

- Where is the internship located? If you are concerned about the basic costs of living, check if any of your potential internships offer a stipend to cover these costs.

- How much busywork do you think you would do? Most internships require a certain amount of busywork but, obviously, some less than others.

- How good is the quality of life? Will you have a nice work space? Are there any extra perks of the position? Does the company culture seem comfortable?

Internships are one of the most beneficial learning experiences you will ever have. Take the time to find the right one for you!



Summer in the Salt Marshes

Still looking for a summer internship? Take a look in your own community. Inquire at the local museum, hospital, or zoo. Check with your school's guidance office. And ask adults you know—your parents, their friends, your parents' friends—if they know of any opportunities.

The following article was written by a student who found an internship in his own backyard, with an organization he wouldn't have considered otherwise, simply by asking. So, what opportunities await you in your community? Now is the time to ask.

Interning at the Audubon Society

by Samuel Gale Rosen

If you're thinking of organizations that explore marine biology, the Audubon Society probably isn't the first to pop into your mind—don't they just study birds? In fact, though, the Society is active in a broad range of environmental research. So when I started looking for a summer internship in marine biology, I talked to a friend of my family who works as a coastal ecologist for the Massachusetts Audubon Society. When I asked him if he knew of any marine biology internships, he suggested that I help out at the Audubon Society.

When I arrived on my first day, I knew from just looking at the place that I would enjoy working there. The Audubon Society office in Wenham is in a large wood-frame house, surrounded by meadows and gardens, one with a small pool filled with carp. I would be helping the scientists there with several projects, including trying to determine how the harvesting of salt marsh grasses affects the marshes, gathering information on populations of organisms in tidepools, and setting up a program to show teachers how to instruct their students about the ecology of salt marshes and coastal environments.

Throughout the summer, I worked two or three days a week, for five to eight hours a day. I worked roughly half of the time at the office and half of the time in the field. In the office, I entered data into spreadsheets, weighed samples of grass, helped write educational materials, picked through big buckets of water for invertebrates to preserve in alcohol, and classified seaweed samples.

This last project was interesting because I had to learn to identify different kinds of seaweed. I began by laying out seaweed samples on wet paper and then allowed them to dry. Once they had dried, I used a field guide and a microscope to identify the species based on their general shape (long and flat, skinny and spaghetti-like, wide and bumpy), size, and color. Sometimes I had to use the microscope to look at the organization of the cells—for instance, how many cells thick the strand of seaweed was.

In the field, I helped count organisms—grass, periwinkles, crabs, sea urchins—along transect lines in both marshes and tide pools. The transect lines were long tape measures laid out straight in the area we were sampling. We collected data by putting down a quadrat, a square wire outline of a particular size (many of which I had made myself out of wire hangers), next to the transect and recording the organisms inside.

I also helped map different areas of vegetation in the salt marsh with a global positioning system (GPS). Using an aerial photo of the area, we located the different basic vegetative areas. The photo had been taken a few years earlier, however, so it didn't always correspond perfectly with the way the marsh looks now. To create a more accurate depiction, we walked through the area looking for the boundaries of different sections of marsh vegetation and marked those points on the aerial photo. Using a small GPS system that could determine precise latitude and longitude down to an area of about 15 square feet, I found the latitude and longitude of those points and then recorded them both in a notebook and in the memory of the GPS system. Later, at the office, the exact location of these points would be fed into a mapping computer program to create an accurate vegetation map of the area. By comparing this map with past and future maps, ecologists will be able to see how the marshes have changed over time.

In general, I really enjoyed the work I did. Weighing grass and entering information into spreadsheets was not so much fun, but most everything else was, especially the field research. By the end of my internship, I could identify many tidal pool species by their scientific names, and I had learned a variety of research and collection techniques and methods. But what I found most rewarding about the experience was learning—and living—what some real scientists do in a day.

Sam Gale Rosen is 17 years old and lives in Gloucester, MA. He attends the Waring School in Beverly. He has always been interested in natural science and is considering studying octopi and squid as a possible career option. Most importantly, he just got his driver's license!

Three years ago, Sagen Woolery opened The Kids' Kitchen, a summer meal service for needy kids. Operated entirely by 8-to-12-year-olds that Sagen has recruited, the kitchen has served more than 4,000 kids.

Last year, Sagen was a national honoree in the Prudential Community of Spirit Awards. This program recognizes individual students in grades 5–12 who have made significant volunteer contributions. More than 20,000 students apply each year. Two students from each state receive awards at the state level; ten of those students are honored at the national level. In addition to receiving cash awards of $5,000, national honorees also have $25,000 worth of products donated in their names to local children's charities.

NETWORKING KINDNESS

The Story of The Kids' Kitchen

by Sagen Woolery

When I was in second grade, I saw a TV commercial about volunteerism and started thinking of ways to help my community. I asked my parents if I could open an animal shelter in our back yard. Of course, they said no and told me to think of something a little more reasonable.

Around the same time, I had been wondering where my friends in school who depend on the free lunch program ate during the summer. This time I asked my parents if I could open a kids' kitchen to feed my friends in need during the summer. They thought it was a great idea, so I started organizing. I was eight years old.

Getting Started

It took almost two years to open the kitchen because there was so much to do to get it started. First, my parents introduced me to Mr. Sam, a very kind retired man who is the director of the year-round soup kitchen in my community. He attends our church, so every week I would try to talk to him about what I wanted to do. It got to the point that he started avoiding me, but I kept on. Finally, he said he would help me, and together we began the kitchen.

I had to speak to clubs in my community to raise money, and I had to get permission from the food bank and the church where we have the kitchen—basically, I had to deal with a lot of adults. One of my biggest obstacles was getting them to take me seriously.

It was much easier to recruit kids to work in the kitchen. I never had a single kid say no. In fact, sometimes I'd have to reschedule kids because I had too much help!

Kids Helping Kids

Some of the kids who came to the kitchen we knew from school. We were always happy to see them, and they seemed happy to see us. No one ever judged anyone—we were just kids helping kids.

By the end of the summer, we were making up to 500 sandwiches a day. I started raising enough money to give out hygiene products like shampoo and toothbrushes each week, and in the last two weeks we gave out school supplies, too. I know those kids really appreciated everything we did.

Many, many mothers would tell me how grateful they were for our kitchen. They would take extra lunches to use for dinner or even the next day's food. We never asked questions; we just felt fortunate to be able to give them whatever they asked.

The response overall was amazing. Once we got started, even the adults who had been skeptical supported my project and wanted their kids to participate. The more it got around, the more people wanted to help out—for example, a couple of farmers brought fresh vegetables every week. So many people got involved. I call it "networking kindness."

A Full-Time Commitment

Summer is the best time for a project like mine. If you are the director or founder of such a program, it's a full-time job. I had to make the menus, recruit the volunteers and schedule them every week, either make sure the food was picked up at the food bank or get the money to buy it and have it ready for the kitchen, and schedule

Continued on page 29

Summer jobs provide a lot more than a paycheck. Depending on where you choose to work, you might learn office skills or how to handle money; you might learn to communicate with different types of people and how to work as part of a team. And, if you're like Megan Chappell, you might even discover the career you'd like to pursue.

THE SUMMER JOB THAT TURNED INTO A CAREER

by Megan Chappell

If someone had told me at the beginning of my high school career that I would want to be a lawyer by the time I reached graduation, I would have laughed. At the time I was a computer nut, an Internet addict, and strongly planning on a computer science major. And I had heard all the good lawyer jokes in circulation (Why don't sharks bite lawyers? Professional courtesy), knew they had a bad moral reputation, and had heard numerous times that "this country has too many lawyers already." I planned on a career as a software designer, or something of that sort, having nothing to do with lawyers whatsoever.

However, in the fall of tenth grade, I was offered a job in a local law office. I accepted, at first because it seemed much more attractive than the typical teenage store clerk/waitress/burger-flipper jobs. My primary tasks included filing completed documents, preparing deeds, preparing property descriptions, doing research at the office of the Clerk of Court and at the Register of Deeds, preparing Final Title Opinions and sending them to the banks, and running various errands. That may sound like a lot of work, but in truth, I did not think it unmanageable. In fact, I enjoyed most of it.

Discovering Myself

Meanwhile, in school, I was discovering that math was not my first love. I could do it, but I was not passionate about it, and did not want to spend the rest of my life with it. That put a serious dent in my plans to major in computer science. If I was disillusioned after pre-calc, how was I going to make it through advanced calculus? I was also discovering that I was much better, and happier, in English classes than I was in math classes. At the same time, my job at the law office had become more and more enjoyable. I worked there during the summer after my sophomore year of high school, and that summer I began to contemplate a career in law. *Why not?* I reasoned. *I love my work, and I love being able to be around such a variety of people. Why not, then?*

I continued to work there until I left for college. I am a freshman in college now, and I am already planning to spend Christmas and summer breaks back in the law firm.

Exploring the Field

The experience was valuable because the tasks I performed are some of the "real stuff" of the everyday business of working in a law firm. I was able to see a lawyer's work from the inside out, and, therefore, I know some of what I am getting myself into. I discovered that law is not all eloquent closing statements and lucrative settlement cases. Law is long hours doing title searches at the Register of Deeds. Law is handling loads of traffic tickets at once and trying to get them all reduced to a lesser charge so that they will not affect the ticketed person's insurance rates. Law is mediation, frustration—and aggravation. But I loved it. I felt as though I had finally found a vocation in which I could use my writing skills and my public speaking skills, and make a good living at the same time. Perhaps knowing how to spend one's life comes as a sudden revelation to some people. But to me, it came as a slow realization that I liked what I was doing, and that I could still see myself in this field in ten years.

Making a Match

Currently I attend Wake Forest University in North Carolina. I am planning to major in English, and I plan to attend law school after graduation. I think I am lucky that I have found what I want to do. My plans may change, of course, but it helps to give my undergraduate career a little bit of focus now.

The flip side to a part-time or summer job in a field you are considering is that you may completely dislike it. However, the experience is still valuable because then you will know what not to major in. I had several friends in high school who thought they knew what they wanted to major in when they began college. Then, after freshman year, they all got summer jobs in their chosen fields. By the end of the summer, each had changed his or her career plans entirely. Most of them considered themselves lucky to have found out relatively early that they needed to rethink their career plans.

Overall, I am grateful for my part-time and summer experiences in law. My job led me to the legal world, which, I think, is a much better match for my skills and aptitudes than that of computer science. And it never hurts to be protected from shark bites.

Megan Chappell, from Candor, NC, hopes one day to be a partner in a successful private law practice. For now, she is enjoying life and playing in the Wake Forest University Marching, Pep, and Symphonic Bands. She is also a member of Kappa Kappa Psi, a college band honor fraternity, and of the WFU Pre-Law Society.

During the school year, many students enrich their academic lives with extracurricular activities such as sports, music, competitions, and volunteer work. But what happens when there aren't enough hours in the day to accommodate all of your interests?

Like the authors of the following two articles, you can plan your summer around the activities you don't have time to pursue during the school year. These students pursued similar interests—Jeremy spent the summer immersed in playwriting and drama, and Michelle mixed music, acting, directing, and travel—and both found it rewarding to spend the summer doing things they love.

Song, Stage, and Travel:

How I Packed My Summer

by Michelle Rengarajan

Each school year, I am so busy with rigorous academics and school activities that I can't pursue many of my interests. So I decided to spend last summer with activities I didn't have time for during the school year: acting, directing, singing, playing piano, and traveling.

Summer Drama

My summer began with a week of driver's education, but then I became involved in three plays performed at my school, which has an excellent theater program. I volunteered as assistant director of a lower school play, *The Pied Piper of Hamelin*, and a middle school play, *The Girl Who Married a Ghost*. I also acted in the high school play, *Fame*. When I started assistant directing, I immediately knew that the experience would be extremely valuable, particularly in expanding my own acting ability. As we analyzed each move and voice inflection the characters made, I discovered the subtleties that separate a mediocre actor from a great one. This helped me tremendously as an actor in *Fame*.

Acting and directing taught me a lot about myself and about people in general. When acting, I had to try to recapture my own fury, grief, and elation, and to transmute that into my character so I could convey it to the audience. To be an effective director, I had to learn different techniques for managing the students at the middle and lower schools. Although I often felt envious when my friends received paychecks working with those children gave me fundamental leadership skills I probably wouldn't have gained in a more traditional summer job.

A Time for Music

I also used the summer to develop my musical skills. Each day after rehearsals, I arrived home around 6:00 p.m. to practice my piano and singing. I have been taking private lessons in piano and voice for six years, and every six months I take piano, voice, and theory exams given by the Associated Board of the Royal Schools of Music from Great Britain. My goal is to finish Grade VIII examinations in all three areas by the time I graduate from high school. In late June, I took the Grade V theory examination, which marked a major step forward and a bridge between lower and upper level musicianship. I also advanced in my singing—practicing arias, art songs, and Broadway show tunes in order to be ready for my next singing exam—and worked on a Beethoven sonata to advance my piano skills. With no homework to do at night, I got to spend many hours singing and playing any song I wanted to, just for fun.

Time Out

By midsummer, however, I felt pretty worn out. I collapsed into bed at 10:00 each night and repeatedly hit my snooze button each morning. As performances of the plays drew near, I spent weekends and evenings helping build sets, work backstage, and put the finishing touches on the shows. For *Fame*, I practiced my dancing, singing, and piano at home, so I wouldn't forget my steps or songs during the shows. All of these extra hours took their toll. One night, exhausted from a full day of tech work, I went to my friend's birthday party, only to fall asleep while we were all watching a movie. I awoke four hours later to find everyone still awake and having fun. I also did not have as much time for summer reading as I would have liked, reading few fun books and only one of my many required books during June and July. By August, I was ready for an escape.

After the plays' final performances, I finally got a break: my parents, my little sister, and I traveled to India for the first time in seven years. I found India extremely enjoyable, especially since I saw relatives whom I had not seen in a long time. My cousins even taught me some Tamil so that I could communicate more easily. I found myself immersed in the culture and was able to appreciate it far more than I had when I was younger.

A Few Words of Advice

My summer proved to be extremely rewarding, but I would not advise that everyone take the same path that I did. If you do plan to pack your summer, it is important to choose activities that you enjoy, especially those that you cannot do during the school year. I would also advise that you enjoy unplanned activities; for me, this included seeing movies with my friends and spending time with my family.

I would also recommend that you make time for the things that you have to do in the summer. I put off much of my required summer reading into the last week of August and found myself having to read five books in five days, while attending Glee club camp at the same time. Despite all this, I found the summer extremely fulfilling, and I learned a valuable lesson about managing my time. I enjoyed the freedom of choosing my activities and using my time to grow in areas that can't come first during the school year. I only hope that I can pack next summer as well.

Michelle Rengarajan is in tenth grade at the Westridge School for Girls in California. Michelle fills her school year with a range of extracurriculars, including track, cross country, Lincoln-Douglas debate, the Science Olympiad, Junior Classical League, and Amnesty International.

Scripting the Perfect Summer:

How to Spend Your Summer Doing the Things You Enjoy

by Jeremy Stoller

At the end of my last school year, I was exhausted. I had spent much of my time doing homework and participating in extracurricular activities, and I had little energy to devote to more personal pursuits. So, with the summer months lying before me, I realized that I wanted to spend time doing what I really love.

Two of my passions, acting and dancing, were nourished when I auditioned for *A Chorus Line* at a local company, DEBUTS, run by a fellow high school student. *A Chorus Line* takes place at a Broadway audition for the dancing chorus in an unnamed musical. Over the course of the show, each character relates his life story. I played Greg, a character who realizes he's gay after making out with his girlfriend.

It was a wonderful experience to be in such a great musical and it was so much fun—especially the performances. There's nothing like having really great performances after a rigorous rehearsal schedule. The show has a lot of dancing, and we rehearsed in a room with no air conditioning or fans and little outside air. But none of that mattered when it came to opening night and the cast gave a knock-their-socks-off performance.

I also devoted part of my summer to writing, after stumbling upon a young playwrights' contest founded by Steven Sondheim. My three-year-long writer's block suddenly disappeared and I wrote my first (almost) full-length, adult play. Titled *Actors Anonymous*, it is a play about a group of supporting cast members who have devoted their lives to the stage and have received little in return. Throughout the play, the cast members question their career choice, dissect their failed relationships, and learn to cope with the challenges of acting. It isn't a masterpiece (yet), but it is a triumph for me. And it helped me realize that I wanted to devote my life to writing plays.

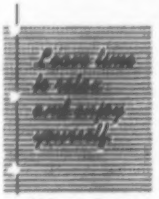
When school started this year, I had to put my playwriting on hold. This school year is busier than last year, with even more time spent on homework and extracurriculars. I am sure that many of you are now in the same situation I am in. But this is the best time to start looking ahead to summer. I'm planning to make this summer even sweeter than the last—and you can make yours sweeter, too.

What don't you have time for during the school year that you really want to do? What won't ever get accomplished if you don't do it during the summer? During the school year, I rarely have the time to read books of my own choice, write, or work on any kind of long-term project. Those are the things I want to do during the summer. You might choose to go to an academic program to study a topic your school doesn't offer. Or you might decide to learn a new language. Summer is a great time for this.

If you have a large number of activities, you may have to rate them according to which are most important to you. Spend time between now and summer re-evaluating the list—and looking forward to the activities you've outlined. Then, when the school year is over, post the list where you will often spot it, and check off each task as it is completed. Not everything will get done, and you probably will not go in the exact direction you planned, but I promise that you will love every minute of it.

I chose to work part-time rather than full-time, although this may not be an option for everyone. I wanted to spend my summer writing a play rather than doing office work all day, every day. A full-time job can put an end to many of the items on your to-do list. You may have to make some tough decisions about what your priorities are.

Start off with one of your smaller projects, but don't wait too long to go to work on one of your major projects. I wrote the bulk of my play in about a month, but it took the rest of the summer to revise, add new scenes, and research playwriting tips. If you don't feel like working one day, then take a break. If something isn't going the way it should, drop it, and move on to something else.



Don't work too hard, even on the activities you love. I never forced myself to work harder on my play than I could. Creativity is not something that can be conjured up on demand. I'd work on my play a couple of hours a day, go to my rehearsals, and spend the rest of the time just relaxing.

So go ahead: write that sonata. Start that Web site. Paint that portrait. Climb that peak. Design that building. Your time to spend doing as you please will soon be gone. We have so many dreams and so little personal time—three months a year to be exact. Spend them wisely.

Jeremy Stoller is 15 years old and lives in Albany, NY. He enjoys writing, acting, art, tap dancing, and playing piano. Jeremy hopes to become a playwright.

THE Great Outdoors

by David Boy

I went backpacking for the first time during the summer after sixth grade. I went to Camp Tekoa, a cozy little campsite in North Carolina. I knew that I had signed up for the "beginner adventure backpacking" trip, but I was hoping it was more "beginner" than "adventure"—the closest I had ever been to camping was sleeping in a sleeping bag.

When I arrived at Camp Tekoa on a Sunday in late June, I quickly ran off to meet my fellow campers. There were 15 of us. For the first three days all we did was pack our food bags, learn how to use camping equipment, and load our packs. Finally, Wednesday morning we all piled into two vans and drove up twisting mountain roads to our drop-off point. All of the campers, myself included, hesitated at the top of the trail. But when our leader set off down the trail, we knew that there was no turning back. The hike had begun.

We fought over who had to carry what; we complained about the slightest incline in the trail; we did the unthinkable and walked barefoot around camp (this is a big no-no in the woods). We ran amok, yet somehow managed to get everything done that needed to be done. Two days later and 14 miles away, our counselors delivered us safely back to camp, and my first experience with backpacking had come to an end.

When It Rains, It Pours

Two summers later—opting for canoeing the year before—I signed up for a backpacking trip at Tekoa again. This time I figured I was advanced, so I checked the appropriate box, "two-week backpacking challenge." Maybe I should have given my choice a little more thought when I found out the leader was calling all the campers to make sure they were tough enough. Or when I found out we were going to be hiking 15 miles a day—farther than my entire last trip—for two straight weeks. Or when I found out we were going to be hiking in a rainforest.

Rainforests receive more than 100 inches of rain per year. Only a handful of rainforests still exist in the United States. One of them is Pisgah National Forest and Wilderness Area in North Carolina, where I went. One of the worst things that can happen when you're backpacking is for it to rain. Rain makes you cold. Rain adds at least 10 pounds to your pack. Rain makes the footing treacherous and the campsites muddy. It is the bane of the outdoorsman and we were going to be hiking in a lot of it.

Once again, I arrived at camp on a Sunday; however, this time we spent only one morning loading our packs, filling them with seven days worth of supplies instead of three. We were on the trail by Monday afternoon. When we started out the sky was sunny, but by the time we reached our campsite, it was drizzling. And then it poured. And it continued to pour for the rest of the expedition.

We quickly settled into a routine of what I like to call "speed hiking." In order to get to the campsites quickly, we would race up hills at a staggering three miles per hour and slide down the other side at four and a half miles per hour. We did this for a reason: if the sun came out, we wanted to be able to drop our packs and take out all our wet stuff to dry. We finished the 130-mile trip in 13 days. It had rained 19 inches.

At the end of my second backpacking trip, I realized that the mental and physical challenge of hiking is what makes the experience so invigorating. Every day you must deal with something unexpected, both good and bad. Each hill needs to be conquered and you don't have a choice about finishing. You can't say, "This is too hard, I'm gonna stop now." If you don't make it to the top of the hill, you're not going to make it into camp that night.

What It's All About

Last summer I took the same hike with the same people as the year before. The only difference was that it didn't rain, but this alone changed the entire trip. We didn't have to rush from campsite to campsite. We had time to enjoy the splendid views, which were now unobstructed by clouds. Each night the seven of us sat around our cooking stoves after dinner and relaxed, instead of huddling in our tents, trying to keep dry.

This is what backpacking is really about. It's about going out into the wilderness with whatever is on your back and living simply. It's about enjoying nature, spending time with friends, and having a lot of time to think. It's about taking things in stride and meeting challenges. There is nothing I would rather do with my summer than strap a 60-pound pack to my back and just hike.

David Boy is a sophomore at Southwest Guilford High School in High Point, NC. He works the sound booth for local theatrical productions and plays varsity sports. Next summer David plans to backpack in Nepal and Tibet (that's the really hardcore stuff).

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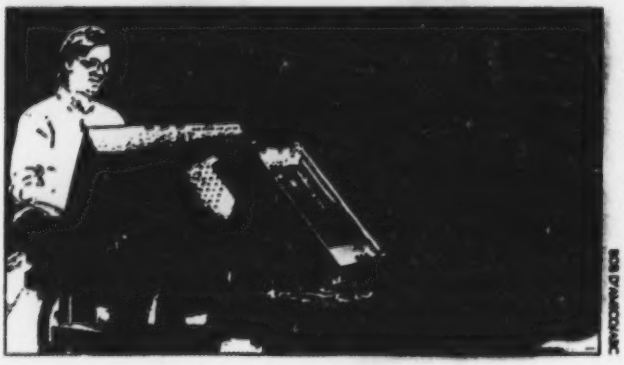
THE PATH TO THE HOT SEAT

INSIDE *WHO WANTS TO BE A MILLIONAIRE*

by David Patrick

I woke up on a Thursday morning just like any other day, not knowing that only four days later I'd be on the most popular game show on national television. I'm still amazed at how quickly everything happened.

Thursday, November 18: For a couple of weeks I had been trying out for *Who Wants to Be a Millionaire* by calling the 800 number. I was in my office when the phone call came. It was a staffer from *Millionaire* telling me that I had been selected to participate in round two of the telephone game, but I had to call back the next day.



Friday, November 19: I called in around 3:00 p.m. and played the second telephone game. Then I had to wait at home while the scores were tabulated. I was pretty sure that I had gotten four of the five questions correct, but I was doubtful that it would be good enough to get on the show. The phone finally rang around 4:20 p.m. It was ABC! I was going to New York to be on national television!

Saturday, November 20: My friend Tricia and I were on a plane to New York City early in the morning. Upon our arrival at JFK, we were met by a driver who took us to our hotel in Manhattan. When we got to the hotel we met with a contestant coordinator who gave me several legal documents to read and sign as well as a copy of the official rules of the game. He also inspected the clothing that I intended to wear on the show—the dress code prohibited t-shirts, stripes, and anything with a logo on it. As he left, we were told to be in the hotel lobby at 7:30 a.m. and to try to get a good night's sleep. Yeah, right!

Sunday, November 21: Finally, the big day. I was in the lobby at 7:30 a.m. and milled around with all the other nervous contestants. Vans showed up to take us to the ABC Studio. We had breakfast there before being taken onto the *Millionaire* set. The set is a lot smaller than it looks on TV, and it was freezing. The executive producer, Michael Davies, came out to talk to us about the game and to give us some advice, the most important of which was: take your time, take as long as you need to think about the question, don't let Regis rush you. After Davies's instructions, we each got a turn in the "Hot Seat" to answer a couple of practice questions. Then we had some practice "Fastest Finger" sessions. When I won two out of the five Fastest Fingers that we did for practice, it hit me: I might actually win a million dollars today. And that's when I got *really* nervous!

There was a contestant left over from the previous day's show, so we had wait while she finished. Then it was our turn. We each got our five seconds of on-camera time while our name was read, and we all knew that this was the only camera time most of us would get unless we won one of the Fastest Finger questions. Regis read the question and I entered my answers. I was pretty sure I had gotten it right, but was I the fastest? Regis read the answers. I was right! Who had the fastest time? I did! At that point, all I could think about was not tripping and falling on my face while I walked over to shake Regis's hand. We went to a commercial break and Regis whispered "good job" to me. He ran to the back room to look over the list of questions that he was about to ask me as the makeup people came out and touched me up. And then I was in the Hot Seat.

While talking with the other contestants earlier that morning, we had all agreed that our biggest fear was not only getting in the Hot Seat, but missing one of the easy questions and going home with nothing except looking like an idiot on national television. Fortunately, I made it to the $1,000 mark with no problem. I had to use two of my three lifelines to get to the $32,000 mark. I knew the $64,000 question, no problem. At $125,000, I got "Which of the following countries is not on the equator? A) Ecuador, B) Kenya, C) Chile, D) Indonesia." I didn't know, so I called my phone-a-friend. He didn't know either, so I walked away with $64,000. (By the way, it was Chile.)

I watched the rest of the show from backstage in a daze. After signing a couple of IRS forms, we went back to the hotel and I called just about everyone I knew.

Monday, November 22: Tricia and I flew back to Seattle, and I made it home just in time to watch the broadcast of my appearance. I had to take my phone off the hook because every radio station in Seattle was trying to call me.

The check came about a week later.

David Patrick grew up in upstate New York, attended Carnegie Mellon University and MIT, and currently resides in Seattle. He is an Acting Assistant Professor of Mathematics at the University of Washington.

Off The Shelf

by Diana Clavier

The Sun Also Rises
by Ernest Hemingway

Published in 1926, *The Sun Also Rises* established Ernest Hemingway as a modern master. Funny, poignant, and uncompromisingly real, this early novel reveals Hemingway's genius for presenting just the right details in straightforward language. Furthermore, Hemingway's profound understanding of human nature shines through in his portrayal of characters struggling to find meaning in a cold and chaotic world.

The Sun Also Rises expresses the angst of the "lost generation," the young men and women who had come of age amidst the horror and devastation of World War I. The novel tells the story of five members of this lost generation who, like so many other survivors of "The Great War," try to stifle their feelings of despair and emptiness with drinking and superficial merriment.

The narrator is Jake Barnes, an American journalist who lives in Paris. Early on, we learn that Jake is in love with the British Lady Brett Ashley, but their relationship is doomed in part by Jake's war wound, which prevents them from consummating their love. We learn a little later that Brett lost her "true love" to the War and is engaged to Michael Campbell, a Scottish bankrupt, who also fought in the war. Perhaps to protect herself from the loss she felt when her "true love" died, Brett never allows herself to become truly close to anyone. Instead, she tries to escape her loneliness through alcohol and a series of meaningless affairs.

Brett fits in well with her male companions, who also hide secret sorrows behind their shallow mirth. This becomes clear in the first section of the novel, which focuses on the contrast between the external and internal lives of the characters. Publicly, they enjoy a seemingly endless round of drinking, dancing, and buffoonery. But they all confess to Jake, whom they consider a trustworthy confidante, that their public personas are a front concealing deep unhappiness. Jake sums it up best as he lies miserably awake one night, thinking about Brett: "It is awfully easy to be hard-boiled about everything in the daytime, but at night it is another thing."

The first section concludes with the arrival of Jake's American friend Bill. He travels with Jake to meet the other three in Pamplona, Spain, for the festival of San Fermin, where all five hope to lose themselves in a week of intense revelry. However, they don't enjoy the festival because all of the men except Bill are in love with Brett. Shortly before they left Paris, Brett told Jake that she had recently spent a weekend in San Sebastian with Robert Cohn, who has become obsessed with her. While in Pamplona, Cohn breaks the set's unspoken code, which may best be summed up as "keep your feelings to yourself," by making his obsession public.

Cohn becomes the scapegoat at whom the others direct their frustration not only with Brett's inconstancy but also with life in general. Of the three rivals for Brett's love, only Jake remains aloof and in control although he is as hurt and jealous as Michael and Cohn. The tension of this section is heightened by the anti-Semitism that emerges as Bill and Michael express their contempt for Cohn. Perhaps as a way to escape the nastiness of her companions, Brett makes an easy conquest of a young bullfighter and leaves Pamplona with him.

As the novel closes, Brett briefly returns to Jake and laments the hopelessness of their love. Her lament is only partially sincere because her attraction to Jake stems at least in part from his unavailability. Since she can't commit to him, he's safe; their relationship never threatens to hurt her as she's been hurt in the past. Since their affair isn't "real," they can never betray each other. However, it shields them not only from the potential pain, but also from the genuine joy of a real relationship.

Thus, Hemingway raises the novel's central question: is a life without pain possible, or even desirable? His answer is a resounding "no." To be alive is to risk pain, and if we try to avoid this risk, we avoid joy as well. Perhaps this is why, despite the novel's rather bleak ending, the title offers a note of optimism, reminding us to "embrace the darkness, for only by walking through the night can you reach the sunrise."

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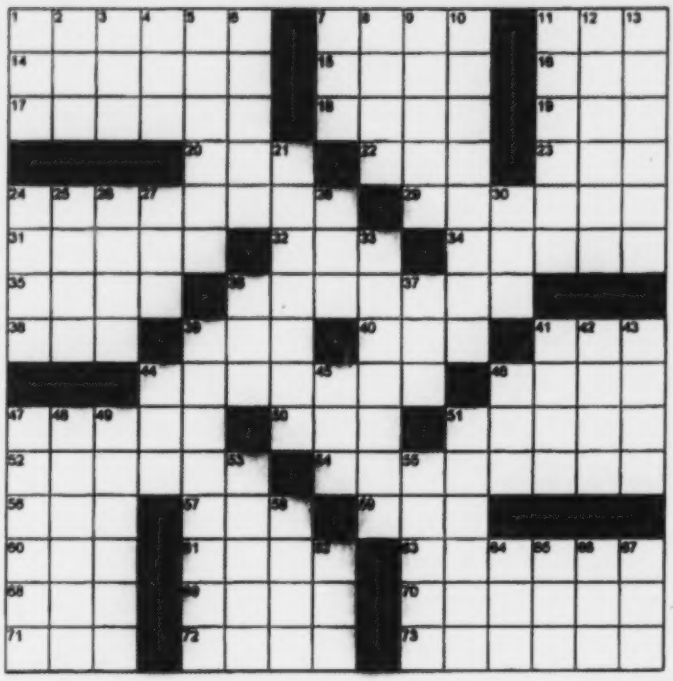
Word Wise: Summer Reading

by Carol Blackburn



ACROSS

1 With 9 Down, he awoke to discover that he had turned into an insect
7 *Born Free* lioness
11 __ *Wednesday*
14 Dramatist O'Neill
15 *Doctor Zhivago* director
16 Shoshonean
17 *The Old Man and the Sea* protagonist's profession
18 Came (Ger.)
19 Scandinavian airline
20 __ feeling
22 Greek letter
23 Explosive
24 Clarissa Dalloway's creator
29 Each
31 *The Deep End of the* __
32 Graphics file format
34 Proprietor
35 Cordelia's father
36 Garcia Marquez's fictional town
38 Doctor of Education (abbr.)
39 Month named for a two-faced god (abbr.)
40 *The Murders in the* __ *Morgue*
41 Nordic sport
44 *Chez* __ cookbook
46 Ender's creator
47 Last word in *The Hobbit's* subtitle
50 T.S. Eliot's Grizabella
51 Tess Durbeyfield's husband
52 Alexandre Dumas's Count
54 Poe's heart
56 Old (Ger.)
57 Shock therapy (abbr.)
59 Mr. Roy
60 Arafat's organization
61 Not mine
63 Fitzgerald's night
68 Load of bricks
69 Character in the old Norse alphabet
70 Suave
71 *Harriet the* __
72 Coup d'__
73 Rises

DOWN

1 General Electric Appliances division
2 *Rabbit* __
3 *The Enormous* __
4 Solidify
5 Pushkin protagonist (Hint: his first name is 14 Across)
6 Repeat
7 *Black* __ *Speaks*
8 Bound
9 See 1 Across
10 The opposite end of the earth
11 Elizabeth Bennet's creator
12 Position
13 Rev. Dimmesdale's abandoned lover
21 1997 summer blockbuster
24 Small rodent
25 Kind of tea
26 Comprehend
27 Long-nosed fish
28 Airman in charge (abbr.)
30 *Sands of* __ *Jima*
33 *A Passage to India* author
36 *Our* __ *in Havana*
37 Nuremberg airport code
39 Mr. Rochester's second wife (2 wds.)
41 Epic tale
42 Space-rock band
43 Inactive
44 *The* __ *and the Pendulum*
45 Rested
46 Count (abbr.)
47 Modifies
48 Move swiftly
49 Shakespeare's Marc
51 Camus
53 Boo Radley's neighbor
55 Water lily
58 Albacore
62 No longer working (abbr.)
64 Athletic association (abbr.)
65 Mr. Defoe, to his friends
66 *Childhood's* __
67 Thing (Lat.)

Solution on page 29

Exploring Career Options: Forensic Science

Interview with Keith McKenney, Ph.D.

by Carol Blackburn

Forensic science is the application of science to legal problems. Forensic scientists include doctors, dentists, chemists, biologists, toxicologists, psychologists, anthropologists, engineers, computer scientists, accountants—all sorts of professionals who apply their expertise to the analysis of evidence pertaining to a crime. The educational paths pursued by future forensic scientists depend upon their eventual area of expertise. A medical examiner completes an M.D. and training in pathology before specializing in forensic pathology. Specialists in other areas complete a B.S., M.S., Ph.D., or D.D.S. in their field, then pursue on-the-job training at a forensic lab.

In addition to the people who spend their days poring over evidence for local, state, or federal authorities, the forensic community also includes people who do research and develop new investigative technologies and resources. In this interview, Dr. Keith McKenney, a professor at the School for Computational Sciences at George Mason University, talks about one of the hottest areas in forensic science—DNA profiling—and how his expertise in genetics and informatics has enabled him to develop next-generation technology for the FBI.

DNA profiling has become one of the most valuable technologies in forensic science, yet it hasn't been around all that long, has it?

No, it hasn't. The first scientific paper on a forensic application of DNA profiling was published in 1985, and the first criminal conviction in the United States based on DNA evidence was in 1988. The FBI has had a DNA-profiling lab for just over a decade. But even though it's comparatively young, it is based upon a very sound scientific foundation, and the technology is incredibly sensitive. We can now recover enough DNA for a profile from a discarded match or a flake of dandruff.

And you're right about its value to the forensic and legal communities. People feel a lot more confident in the justice system when DNA evidence is used to indict or exonerate people. In the past, juries have tended to err on the side of leniency in handing down verdicts and sentences. But when there is DNA evidence, juries tend to give the maximum sentence. Increasingly, people who commit violent crimes will get sentences that fit the crime.

How much is DNA profiling now being used by the investigative community?

It varies by state. For a decade, the FBI and the Department of Justice have been working toward the goal of having a national database of DNA profiles of violent offenders—a resource that local, state, and federal investigators could

contribute to and draw upon in their work. Because most violent crimes are state (not federal) crimes, laws to mandate DNA profiling had to be passed and funded on a state-by-state basis. Now, all 50 states have passed laws mandating DNA profiling of people who have committed murder or violent sexual assault. Most states also mandate profiles of people convicted of lesser charges, like aggravated assault. Nearly everyone who murders or rapes has previously committed aggravated assault or burglary, so if we can get their DNA profile into the database after they commit a lesser crime, we can ID them when they commit a more serious one.

In October 1998, the National DNA Index System (NDIS), which is administered by the FBI, finally went online with the beginnings of a national database of violent offenders. At present, DNA-profiling labs are swamped. They have their hands full working on active cases; and on top of that, there are over one million blood samples from convicted murderers and rapists sitting in freezers around the U.S. waiting to be analyzed and entered into NDIS. Congress recently appropriated $15 million to help states work on that backlog.

It will take a few years, but once we get the data into the system, NDIS will be a tremendous resource. We know this because we see what's happening now in Britain, which is about five years ahead of us in this process. Britain began building a national database in 1995, when the government passed a nationwide law mandating the collection of a DNA sample from everyone arrested for a jailable offense. They now have 800,000 DNA profiles in their database, and every week they get 500–1,000 matches or "hits" in response to queries from constabularies around the country. If investigators find biological evidence at a crime scene, they have a 40% chance of being able to match that DNA to a profile in the database. It is making a big difference in the number of cases they solve. Once NDIS is reasonably well populated, we'll be looking at 3,000–4,000 hits a week. And what that will mean is that a lot of rapists will be caught after the first rape, not the third or fourth.

Just what is a DNA profile? And how are those "one in a million" statistics that lawyers cite in court estimated?

In a DNA profile, you don't look at the entire genome; you analyze just a few specific sites that vary considerably between individuals. At each of these sites, a sequence of base pairs is repeated many times; however, the precise number of these "short tandem repeats" (STRs) varies from person to person, creating different alleles. To generate a DNA profile, you determine the number of repeats at each of 13 standard sites. The use of a standard set of sites makes it possible to compare DNA profiles generated in different labs and different states.

To understand the statistics, imagine a site that has 10 alleles. For simplicity, assume that all 10 alleles occur with equal frequency in the population. Because we're diploid, analysis of that site will yield two STR scores, one from each chromosome; one chromosome might have 12 repeats, the other 17. There are 10 x 10 = 100 possible combinations. However, the technology doesn't distinguish (12,17) from (17,12), so for statistical purposes, there are only 50 possible combinations*. In this case, then, the probability of finding a person at random who has a given STR pattern at that site is 1 in 50. If you analyze a second STR site that also has 10 alleles, you again get a 1 in 50 discrimination. When you look at the results from *both* of those sites, the discrimination power is the product of 50 x 50 or 1 in 2,500. By the time you analyze all 13 sites, you get into identifier numbers that are 1 in 10^{13} to 10^{16}. It has been estimated that fewer than 10^{12} people have ever lived, so in most cases, 13 loci are adequate.

How did you get involved in DNA profiling?

First, I should clarify that cells contain two kinds of DNA, both of which are used by forensic scientists. So far, we've been talking about what people usually mean by DNA profiling, which is *nuclear* DNA profiling. But cells also contain mitochondrial DNA (mtDNA), and that's what I work with. The mitochondrial chromosome is passed from mother to child, so it exhibits a different inheritance pattern than nuclear DNA: you, your siblings, your mother, and your mother's mother all have the same mtDNA. Obviously, mtDNA cannot be used to uniquely identify a suspect as the source of a biological sample. But it can point a finger at a family; and, like all DNA evidence, it can rule out a suspect as the source of a piece of biological evidence.

Even though mtDNA is not as conclusive as nuclear DNA in criminal investigations, it has other things going for it. A cell contains about 10,000 times as much mtDNA as nuclear DNA, so you can often recover mtDNA from old or degraded evidence long after the nuclear DNA has broken down. And because it passes from mother to child, mtDNA can be a very powerful tool in identifying family ties. It was crucial in one of the most famous cases in the annals of forensic science: the identification of the remains of the last Russian tzar and his family. The tzar and his wife were conclusively identified by comparing their mtDNA sequences with those of people alive today who are related to them by unbroken female lineages.

I first became interested in mtDNA when I did post-doctoral work with Fred Sanger, the man who sequenced the mitochondrial chromosome. I later went to the National Institute of Standards and Technology (NIST). While there, I saw that mtDNA would be the next technology to be developed in forensic DNA analysis, and I got involved in defining standards for mtDNA profiling.

The technology to analyze DNA sequences has advanced so rapidly. How has that affected your work?

During the '90s, as computing power skyrocketed and DNA-sequencing technology became increasingly automated, a revolution was taking place within genetics,

Continued on page 28

creating what we now call genomics; and I wanted to be a part of it. To upgrade my computer and informatics skills, I joined The Institute for Genomic Research (TIGR), where I contributed to several whole genome sequencing projects, including the first complete sequence of a microbial genome, *Haemophilus influenzae*. It was very exciting for all of us when that milestone in biotechnology made the front page of *The New York Times*.

Did you do any more work on mtDNA at TIGR?

I wasn't expecting to, since it had already been sequenced, and TIGR's charter is to sequence genomes that have not yet been done. But one day, the director of the lab came to me and said, "Keith, you know something about mtDNA. We just received some samples from an ancient Inca mummy that has just been found. Do you want to take a crack at this?" We analyzed "Juanita"'s mtDNA and searched the existing databases to see who her closest modern relatives were. Two years later, I got a call from Johan Reinhard, the high-altitude archaeologist who had found "Juanita," when he discovered three mummies of children. They were so well preserved that we were able to do nuclear as well as mitochondrial DNA profiles. Analysis of their mtDNA showed that they had three different mothers; but the nuclear DNA profiles of the two girls were similar enough to suggest that they were probably half-sisters. Being able to use DNA markers to infer things about unidentified people who died 500 years ago was really fun.

TIGR was a great place to learn genomics and informatics technologies. The only frustrating thing about working there was that as soon as we finished sequencing a genome, we had to move on to the next organism. For someone interested in genetics, getting the sequence isn't the *end* of the process; it's just the *beginning* of the really interesting work. With the sequence in hand—the sequence of a single member of that species—you can start to look at the genetic variability within that species, where the variations are, what they translate into in terms of differences in gene products. A million questions leap to mind. So after two years at TIGR, I moved to the position I now have, where I can follow up on some of those questions.

Like what?

One of the first things I wanted to do with my new skills in genomics was to look at the natural genetic diversity among humans with respect to mtDNA. Half of the 37 genes on the mitochondrial chromosome are associated with human diseases, so mtDNA diversity clearly has profound medical consequences.

I soon realized that mtDNA diversity was also of interest to the Justice Department. They were beginning to use mtDNA, but whenever they took mtDNA evidence into court, they got hammered. That was because no one knew enough about the natural diversity of mtDNA to be able to generate meaningful statistics, like the ones we talked about earlier. I got really excited and said, "I can build a database that will really help you in the courtroom! When do you need it?" "Last year," they replied. I got a $1.1 million contract from them to build the FBI's next-generation mtDNA database and the associated technology to manage it. It took two years. We just finished in October, and in the process developed some really excellent informatics technology to assist in human identification.

Will that technology have other applications?

Yes. I was very pleased when the FBI decided to use it on another important project. Last year, Congress appropriated $2.6 million for the FBI to implement a missing children's database. Most of that money will be spent developing DNA and mtDNA profiles of the parents of missing children.

Our technology is also being used by the Bosnians to help identify the remains of the 25,000 unidentified casualties from their war with the Serbs. We persuaded the manufacturer of the DNA-sequencing equipment to donate $1 million-worth of instruments to them for this cause, and other European nations are providing additional funds. There's a ray of light amidst this terrible tragedy. Once the job of identifying the bodies in Bosnia is complete, they plan to use their technology and the expertise they will have developed as a global resource to help with missing persons identification around the world.

You now direct a graduate program in forensic science. What do you see happening in the future of this field?

Right now we're dealing with the challenge of building and populating the various DNA databases. But once that's done, the next wave in forensic science will be to integrate information across many databases. That means informatics. There are so many databases with so many different kinds of information: DNA, mtDNA, fingerprints, shoe prints, modus operandi, psychological profiles, criminal records, prison records—the list goes on and on. Today, if you have a shoe print from one crime scene, a hair sample from another, and a partial fingerprint from a third, the investigator has to try to put the pieces together. He may never make the connection that the owner of the shoe went to school with the person who left the partial fingerprint, and that his brother was in prison with the guy who lost a hair—that all these crimes may be related.

In a few years, when we have the informatics technology to link the databases, a query about the DNA profile of sweat from the lining of a discarded shoe could uncover connections between seemingly unrelated crimes. If students would like to have a profound impact on forensic science, they could do nothing better than to become really knowledgeable about how to use databases and how to extract information from large data sets. Having strong computer skills and a keen interest in public safety and welfare would be a great combination.

Selected Resources

"A New Breed of High-Tech Detectives," by Andrew Watson (*Science* 289: 850-854, 11 August 2000).

"The Last Romanov Mystery," by Robert K. Massie (*The New Yorker*, pp. 72-95, 21 August 1995).

For links to Internet resources on forensic science and DNA profiling, see: *www.jhu.edu/gifted/imagine/links_83.htm*

*Mathematically inclined readers will notice that the statistic is actually 1 in 55. In a 10 x 10 matrix, only the off-diagonal elements are duplicated; the on-diagonal ones are unique.

Filmmaker–continued from page 13

young filmmakers. Months later, we were elated to learn that *Just a Dirty Day* was selected to air on HBO Family's *30 by 30: Kid Flicks*.

The Final Cut

Last summer, I returned again to film school and worked on a film called *Twist of Fate*. Its storyline centers on the saying, "what goes around, comes around." Someone in my group came up with the idea when, walking home from class, she noticed a lot of homeless people along the way and started thinking about how they had gotten into that situation. Our group collaborated to create the final story, in which someone who steals money from a beggar becomes a beggar, only to have someone steal from her.

We shot on the back lot of Paramount Studios, and when we had the film the way we wanted it, we got to work on the soundtrack. A professional musician watched the film and composed a soundtrack based on both what he got out of the film and what we wanted the audience to get out of it. When we watched the finished film in a Paramount Studios screening room, we could hardly believe how polished and professional it looked.

Making Movies

With all that I learned at The Young Filmmakers Academy, I have been able to make small movies at home and even create projects for class. For example, this year I had to create a multimedia report about the World Wars. I chose to do my report on propaganda used by various countries to support the war. I created the project on a camcorder, wrote and narrated the story myself, and did all of the camera work. I then transferred it from my camera to a VHS tape, which I took to school to present to the class. I've also filmed things for other people, including a school play that my school sold as a fund raiser.

Learning to make films over the past three summers has expanded my mind and given me the chance to communicate my ideas and convey my feelings. I still love the movies, and I still create videos in my mind. The only difference now is that I don't simply long to be a filmmaker. I am a filmmaker.

Kathleen Worrell is a 14-year-old high school sophomore who enjoys travel, reading, film, theater, art, music, and following sports. Kathleen's favorite subjects in school include biology and theology. She plans to pursue a career in filmmaking.

The Young Filmmakers Academy offers hands-on film and video production workshops for students ages 9 to 17. Students learn skills in acting, directing, editing, theater, photography, animation, and writing.

For more information: The Young Filmmakers Academy, 6374 Arizona Circle, Los Angeles, CA 90045; (310) 215-8106; info@youngfilmmakers.org; www.youngfilmmakers.org

Networking Kindness–continued from page 18

transportation—generously provided by my mom—for the volunteers.

I couldn't run the kitchen last summer because I have advanced scoliosis and was being fitted for braces. But it turned out that I ended up working even harder. Because I won the Prudential award, I received $25,000 worth of books and clothes. It took me most of the summer to divide and distribute everything to more than 25 different charities in Georgia. I also spoke to several groups about volunteering. I really believe that every person who volunteers becomes better in some way, and so does the world.

After Kids' Kitchen

I'm not sure if I will run the kitchen next year; I think I might retire. I have to see what happens with my medical problems.

In the meantime, I'm working for the first time on a project called Christmas for Kids, which brings Christmas to foster and homeless kids. We hope to raise over $65,000 (Land's End gave me $5,000, which is a start). I've asked friends at school to help me wrap the hundreds of gifts; then, high school kids will deliver them. It's a really great project. We hear the saddest stories about kids in need, and it breaks my heart to know that so many do without so much. I am a very lucky girl.

Sagen Woolery turned 13 in December. In addition to her volunteer work, she is active in cheerleading, band, yearbook, and her school's Beta, prayer, and drama clubs. She is also Miss Dogwood, Miss Georgia Peach, and a student reporter for WMAZ-TV. Sagen welcomes e-mail (pwoolery@aol.com) from students interested in starting a project like hers.

For more information about the Prudential Spirit of Community Awards, visit Prudential's Web site at www.prudential.com/community/spirit/ or call (973) 802-4568.

Solution to Word Wise

More about ... Gregor Samsa

Just what sort of insect did the protagonist of Franz Kafka's *The Metamorphosis* turn into? In his *Lectures on Literature*, writer and lepidopterist Vladimir Nabokov carefully examined the evidence, concluding that Gregor was a beetle, not a cockroach, as some uncharitable translators have made him. "Curiously enough," Nabokov continued, "Gregor the beetle never found out that he had wings under the hard covering of his back."

G	R	E	G	O	R	■	E	L	S	A	■	A	S	H
E	U	G	E	N	E	■	L	E	A	N	■	U	T	E
A	N	G	L	E	R	■	K	A	M	T	■	S	A	S
■	■	■	G	U	T	■	P	S	I	■	T	N	T	■
V	I	R	G	I	N	I	A	■	A	P	I	E	C	E
O	C	E	A	N	■	T	I	F	■	O	W	N	E	R
L	E	A	R	■	M	A	C	O	N	D	O	■	■	■
E	D	D	■	J	A	N	■	R	U	E	■	S	K	I
■	■	■	P	A	N	I	S	S	E	■	C	A	R	D
A	G	A	I	N	■	C	A	T	■	A	N	G	E	L
D	A	N	T	E	S	■	T	E	L	L	T	A	L	E
A	L	T	■	E	C	T	■	R	O	B	■	■	■	■
P	L	O	■	Y	O	U	R	■	T	E	N	D	E	R
T	O	N	■	R	U	N	E	■	U	R	B	A	N	E
S	P	Y	■	E	T	A	T	■	S	T	A	N	D	S

Planning Ahead for College

by Linda E. Brody, Ed.D.

Getting the Most from College Visits

You've scanned the Internet and read about colleges—now it's time to see some colleges for yourself. How should you plan for these visits? What should you look for when you get there? The answer depends on where you are in the college planning process.

If you're in middle school, exploratory visits can help you define what's important to you. Visit local colleges and tour campuses when you're vacationing in another part of the country. Consider how you feel walking around a lush campus full of greenery versus an urban campus with the bustle of lots of people. Start thinking about the attributes that are important to you.

If you're in 9th or 10th grade, your interests are more defined, and you have some sense of the type of college you want to attend. Make a reasonably long list of colleges that seem to meet your needs, and then try to visit these schools. The summer after 10th grade is an ideal time to tour college campuses and to reduce your list based on these visits.

Juniors and seniors should be visiting colleges for the purpose of making final selections. If you've followed our advice, by now you will have a "short" list of colleges, and your visits will be second visits in most cases. This column focuses on this visit—the one where you are trying to choose a college where you will be happy for four years.

After identifying a group of colleges that offer the major field of study and ambiance you think you want, it's time to plan more intensive visits that will help you distinguish among these colleges and choose the one that is right for you. Below is a list of suggestions for getting the information you need to make an informed choice.

Take the campus tour and attend the information session. This suggestion may be obvious, and you may have done this on a prior visit to the college. But do it again—you may learn a great deal from hearing the answers to other prospective students' questions.

Schedule an interview. A personal interview with the admissions staff may give you an edge in being accepted. But even if it doesn't, it's a chance to learn more about the college one-on-one with a knowledgeable person. Prepare your questions in advance and take advantage of this opportunity to have them answered.

Make an appointment with a professor in the department in which you plan to major. You should do this only if you're serious about the college and reasonably close to applying. But if your college choice is dependent on departmental offerings, don't just read the catalog listings. See how interested this professor is in working with undergraduates, and inquire about plans for the future of the department. If you're interested in doing research in the department, ask about opportunities to do so.

Inquire about non-academic activities. If you plan to participate in activities that you enjoyed in high school, such as playing in the orchestra, playing a team sport, or writing for the school newspaper, check out the availability of such activities and what you need to do to become involved. Students at competitive schools are often surprised to find they don't make the varsity team, or they aren't chosen to write for Harvard's newspaper or to sing in Yale's Glee Club. If this happens to you, are there alternatives? Are activities available that you didn't do in high school that sound like fun?

Spend a night in a dorm. This will give you a chance to experience dorm life at this college. Is it noisy? Crowded? Well-lit? Far from campus? You can also get to know some students and find out what they do and do not like about the college. (Overnight stays can usually be arranged through the admissions office.)

Eat in the cafeteria. Again, it's a chance to talk to students. But also, do you like the food? If you have special dietary needs, can they be met here?

Read the student newspaper. This can inform you about the issues that concern students on campus. Are the stories heavily political? Or about the sports teams? Are they writing about students who sound like people you would like to know? Do the stories reflect your interests?

Read bulletin boards. This may sound strange but, again, these boards reveal students' interests. There are usually announcements about meetings and events on campus—do these interest you?

Sit in on classes. While this is one of the main reasons to visit a college while school is in session, you could get a false impression from seeing just one class. So, try to visit a large lecture, as well as a smaller seminar-type class. Also, visit classes from several departments. Evaluate the quality of teaching and the degree to which students are engaged in learning. Are classes taught by professors or graduate students? Are the classrooms nice with adequate facilities?

Walk around the campus. You walked with the tour group; now tour on your own. This may take you to areas you didn't see and will

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allow you to spend more time where you wish to. Observe where students hang out on a nice day. Do they rush between classes or linger and talk to each other? Check out the bookstore—is it well-stocked and attractive?

Walk around the town. How far is it to shopping or to restaurants? Does the town seem friendly to students? Does it seem safe?

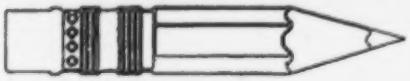
Investigate transportation to the nearest city as well as to your home. If you expect to ever leave campus, even if it's just to go home on vacations, check out the logistics and the cost of doing so. If you want to spend a lot of time in New York City but are considering a college in Connecticut, is that realistic?

Talk to students. If you've done all of the above, you should have met a lot of students by now. But be sure you've made a point of talking to students. They are the ones who know what it's like to live and attend classes at that college or university.

As you evaluate class size, neighborhood, dormitory arrangements, food, and other aspects of life on campus, remember that there is no absolute right answer for everyone. You need to determine what is right for you, where you will feel comfortable, and which college environment will be supportive of your personal and academic needs. College is a big investment and an important decision, so it's worth taking the time to fully investigate your options.

Mark Your Calendar...

with these February–May deadlines and event dates for selected academic competitions. Inquire about competition format, dates, and fees.



Early Feb–early Mar — **National Science Bowl**—Teams of high school students compete first in regional contests (see Web site for your state's contest date); winners advance to the national contest held May 5–8. *Sue Ellen Walbridge, Office of Science, U.S. Department of Energy, 1000 Independence Ave., SW, Washington, DC 20585; (202) 586-7231; Sue-Ellen.Walbridge@oer.doe.gov; www.energy.gov/sciencebowl*

February 2 — **Toshiba/NSTA ExploraVision Awards Program**—Students register in teams: grades K–3, 4–6, 7–9, 10–12. *Toshiba/NSTA ExploraVision Awards, 1840 Wilson Boulevard, Arlington, VA 22201-3000; (800) EXPLOR-9; exploravision@nsta.org; www.toshiba.com/tai/exploravision/main.html*

March 2–23 — **National French Contest**—French teachers register students in elementary through high school to take this exam offered at seven levels. *American Association of Teachers of French, Le Grand Concours, P.O. Box 32030, Sarasota, FL 34278; http://aatf.utsa.edu/concours*

March 15 — **Harvard Biological Sciences Olympiad**—Sponsoring teachers register students in grades 9–12. Students first take a 90-minute school-wide selection examination; two students from each school will be selected to take the national exam. *Ravi Shah, HBSO director, (617) 493-3320; rshah@fas.harvard.edu; www.hcs.harvard.edu/~hsr/hbso/elig.html*

March 31 — **NASA Ames Research Center Annual Space Settlement Contest**—Individuals through entire classrooms in grades 6–12 develop space settlement designs. Entry forms available online. *Al Globus, MS T27A-1, NASA Ames Research Center, Moffett Field, CA 94035; http://lifesci3.arc.nasa.gov/SpaceSettlement/contest*

April 1 — **Destination ImagiNation**—Teams of students from kindergarten through college register to participate in this creative problem-solving contest. *Destination ImagiNation, P.O. Box 547, Glassboro, NJ 08028-0547; (856) 881-1603; headquarters@destinationimagination.org; www.destinationimagination.org*

April 2 — **Physics Bowl**—Schools register to administer this 45-minute exam to students in grades 9–12. *AAPT, One Physics Ellipse, College Park, MD 20740; (301) 209-3344; aapt-prog@aapt.org; www.aapt.org/programs/physbowl.html*

April 4 — **Knowledge Master Open**—Junior, middle, and high schools register teams to participate in a computerized test covering 14 curriculum areas that will take place on April 19. *Academic Hallmarks, P.O. Box 998, Durango, CO 81301; (800) 321-9218; kmo@greatauk.com; www.greatauk.com*

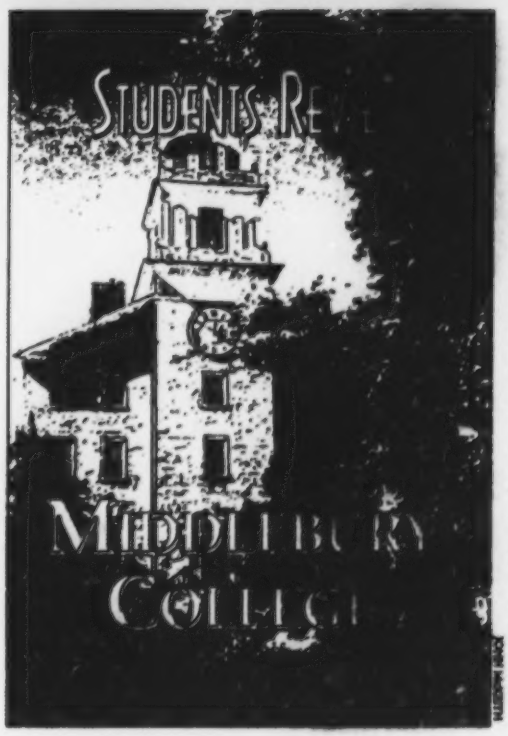
April 13 — **United Nations National High School Essay Contest**—Students in grades 9–12 submit a 1,500-word essay on the year's topic. *United Nations Association of the USA, 801 Second Avenue, New York, NY 10017, (212) 907-1326; jgagain@unausa.org; www.unausa.org/programs/nhsessay.htm*

May 1 — **American Regions Math League (ARML)**—Teams of students in grades 7–12 register for national competitions held June 1–2 at Penn State and Universities of Iowa and Nevada. *Mark Saul, ARML President, 711 Amsterdam Avenue, New York, NY 10025; (212) 666-5188; MSaul@compuserve.com; www.arml.math.org*

May 18 — **National Academic Championship**—High school teams register to compete in this general-knowledge contest. Local winners advance to the national contest, which is held June 14–17. Reduced fee for registering by May 1. *Questions Unlimited, P.O. Box 14798, Columbus, OH 43214; (800) 868-1518; Qunlimited@iwayne.net; www.qunlimited.com*

The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 17 students, who major(ed) in American civilization (2), art history (1), biochemistry (1), English (4), environmental studies (1), film/video (1), French (2), German (1), international studies (1), math (1), music (2), political science (2), Spanish (1), and theatre (3). (The number of majors exceeds 17 because several students have double majors.) Students' comments appear within quotation marks.



Quality of Academic Instruction for Undergraduates

Reviewers enthusiastically praised Middlebury's faculty, their accessibility, and the quality of the education they offer.

"I would put Middlebury toe-to-toe with any college in the country when it comes to the quality of instruction for undergraduates. The professors go out of their way to be a part of the community. They share their personal academic interests and passions with their classes, often inspiring independent projects among their students. Classes are small enough to facilitate in-depth and individualized exploration of the materials. And even in the larger introductory courses, small discussion sessions led by the professor are part of every week's instruction. The only place you will ever find a TA is in the foreign languages, where native-speaking graduate students from other countries add an authentic conversational and cultural element to the classes."

"Fantastic. Professors are known by their first names, give their home phone numbers, go skiing with you, and hold review sessions in their homes. Middlebury professors are eager to help students who seek them out. Class size in most upper-level courses is small (20 students or less) and very conducive to frank and open discussions. Large introductory courses, with around 70 students, include lab or discussion sections where professors will know your name. The grading system is fair, and grade inflation doesn't occur. You earn your grades at Middlebury."

"Absolutely first-rate. My first semester there, I took a freshman seminar called 'Introduction to Fairy Tales,' which pretty well describes the four years I spent at this undergraduate paradise. The core curriculum is flexible and forces students to expand beyond what they think are their 'strong suits.' Some professors have more accessible personalities than others, but all are there when you need them. The beauty and majesty of the mountains are an added bonus that helps students keep things in perspective."

"Excellent. The core courses allow students to develop the ability to integrate information from a variety of disciplines and encourage the honing of written and verbal communication. I felt that the core curriculum was outstanding, although some students feel that it imposes tougher requirements on science majors than humanities majors. If there is a weakness, I would say that Middlebury did not prepare me fully for doing independent research, although I know people who would not agree with this."

"Middlebury's study abroad program is outstanding. The semester I spent in Madrid was among my most memorable and valuable college experiences."

Social Life

"Nestled in a valley in the Green Mountains of Vermont, Middlebury is somewhat isolated. Rather than a liability, I found this to be a great advantage. The location almost mandates that students remain on campus on the weekends, and this allowed me to build some of the strongest friendships I have ever made. My friends are like my family."

"Social life is vibrant. A variety of options exist for those interested in outdoor activities, parties, dances, music, and theater. In both athletics and the arts, Middlebury's facilities are excellent. There's no nearby city to rely on, so creativity is a must, but most Middlebury students have a great time outside of class."

"The social life is great. The 'social houses' (co-ed fraternities in spirit) host open-campus parties every weekend; and there are plenty of other venues, from dormitories to clubs to sports. There's no glamorous cosmopolitan scene, but there always seemed to be something cultural happening on campus. Such an effort is made to bring cultural events to campus that it would not surprise me if Middlebury has more cultural activities than many small cities."

"Even though Middlebury is geographically isolated, few students are ever bored. The college brings in amazing speakers and performers, from John Irving to the Harlem Gospel Choir, and the social houses host open-campus parties every weekend. The city of Burlington is only 45 minutes away; however, in four years, I found that I went to Burlington only about once a year. For those who feel a need to venture to the 'big city,' New York, Boston, and Montreal are all within a three- to four-hour drive."

What Do You Like Best about Middlebury?

Location, location, location. And friends.

"The location. I cannot express the breathtaking beauty of the campus. Being outside a great deal is an inevitability and a great joy at Midd."

"I became a well-rounded person at Middlebury. Many of my graduate school

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classmates are excellent students but are lacking in other dimensions. Middlebury encourages you to excel not only in school, but in all aspects of life."

"The campus and environment. The facilities themselves are beautiful and top-notch, and they work well with the natural environment. I don't think I ever anticipated how much I would come to love and admire Vermont. I also cherish the friendships I made; I feel very fortunate to have met the friends I did and shared the experience of Middlebury with them."

"Middlebury allowed me to pursue my creative interests in theater arts, acting, directing, and filmmaking, while affording me the opportunity to participate in a remarkable and varied academic education, all in the marvelous and inspiring environment of the Vermont countryside."

"The friendships I made while there and continue to make with fellow alumni. I'm amazed at how excited people are to meet a fellow Midd Kid. Even after graduation, you are part of a warm and embracing group of alumni that allows you to build friendships and networks throughout life. It has helped so much in terms of meeting new people, finding a job, etc."

"I loved the athletics at Middlebury. The coaches always remind you that you're at Middlebury for an education first, to be an athlete second. It's a really nice balance, knowing that you can be both academically and athletically serious, and that both your professors and coaches support you in that dual role."

What Do You Like Least about Middlebury?

Reviewers mentioned issues common to most small liberal arts colleges in small town settings: the insularity, the limited curriculum, and the lack of racial diversity. Others noted that "Vermont can be very, very cold in January!"

"Although the school's smallness has several perks, it can be stifling, especially in your junior or senior year. It's understandable why so many juniors study abroad."

"I always hated leaving Middlebury for the summer. Spring is so short in Vermont, and the summer so beautiful, that I always wished I could stay. I wish Middlebury had a program (as Dartmouth does) in which the whole class would spend one summer together on campus."

"Middlebury has a well-deserved reputation for language instruction. However, students should be aware that language instruction and theoretical linguistics are very different fields. My interest was linguistics, and the school didn't have any classes, much less a major, in this subject. This really hurt me when it came to applying to and succeeding in graduate school."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Middlebury?

"Someone with a healthy, happy attitude—who works hard, but with a big smile. Someone who is academically motivated, enjoys the outdoors, and is appreciative of his or her surroundings. People are generally happy, and the long winters make for intense and meaningful friendships."

Middlebury College

Middlebury, VT 05753
(802) 443-3000

- 4-year private coed liberal arts college
- Campus in a small town in rural Vermont
- Full-time undergraduate enrollment 2000-2001: 1,121 men; 1,159 women.
- Special features: Intensive summer language program (open to students from others schools); study abroad programs in France, Germany, Italy, Russia, and Spain.

"An intelligent person who knows how to enjoy life and who realizes that there's more to college than grades and classes. If you want to stress about your grades or talk about philosophy all night every night, Middlebury's probably not the place for you. But if you want to make incredible friends, be pushed in the classroom, learn to ski, and be a part of a vibrant community, Middlebury's the school for you."

"Someone who wants to be part of a true community and add something to the experience of others. A Middlebury student should be confident enough in his or her own character to eagerly embrace the intimacy fostered by the school and setting."

If You Had It to Do over Again, Would You Go to Middlebury?

All but one reviewer gave an unqualified yes.

"In a heartbeat. Middlebury gave me a great education and an address book full of absolutely amazing people (students and professors alike), and it developed my mind, spirit, and character to strive for success in all sorts of endeavors."

"Without a doubt. Five years out of college, I find that I am still envious of the freshmen who are just entering Middlebury, for I know that they are heading into an incredible four years that will change their lives forever, and for the better. Middlebury isn't just a college, it's a spirit that infuses you and changes how you approach your life. It changes your attitude."

"Absolutely. My academic experience, social experience, athletic experience, and friendships are things I cherish and would do again given the opportunity. I'm convinced I have a broader view of life than many of my graduate school classmates who attended schools where stress and great grades were the entire culture. I'd choose Middlebury again in a heartbeat."

"Yes. It was too beautiful and academically rewarding to pass up. My college friends and I fly around the country, convening for long weekends and group vacations. I have yet to meet better people."

"I'm not sure. I loved Middlebury, but I believe I would also have enjoyed myself at Bowdoin, Williams, Amherst, or any of the other schools in the New England Small College Athletic Conference. When it comes to the Middleburys of the academic world, you probably can't go wrong."

As you try to find the college or university best suited to you, the views presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different school. At any college, it is important to seek out challenging academic experiences and to create a social life that fits your personal style.

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

THE COACH'S CORNER

The Top Ten Things No Debater Ever Hears Enough: Advice for Lincoln-Douglas and Policy Debaters

by Carlos Rodriguez

Ever since the National Forensic League announced this year's Lincoln-Douglas and policy debate topics, you've been researching and practicing and competing. Now that you're halfway through the school year, these reminders might help you continue to improve your performance in the rest of the year's debates.

Work, work, work. Be diligent in your research. Use libraries, the Internet, and any resources available to become an expert in the topic area. The more you understand, the easier it will be to formulate coherent, persuasive arguments against the opposition. Also work hard at developing your speaking skills so that you can present your position fluently, clearly, and convincingly. Participate in as many practice rounds as possible, and take them seriously.

Be organized. Do what you can outside the round to ensure that things go smoothly inside the round. Meticulously file all of your evidence. Each partner should know the files backward and forward. The chaos that results from not being able to find a piece of evidence wastes prep time and damages the credibility of the team. Within the round, a team should function like a well-oiled machine, seamlessly pulling evidence and constructing speeches. A well-planned division of responsibilities is crucial in this regard.

Maintain a mature demeanor. Debate is an academic activity. To be credible, debaters must comport to professional standards of dress, speech, and conduct. Dress appropriately, as you would for a job or college interview. Speak articulately. Avoid slang and curse words.

Be confident, yet courteous. Not only is being rude or abrasive to your opponents (or your partner) unpleasant for everyone in the round, but it also might result in a vote against you. Although the judge might not make a conscious decision to vote against you as a result of your disposition, it will be easier for her to vote against someone she doesn't like.

Remember that your job is to convince the judge. Debate is a very simple discursive game. The goal is to offer an argument, constrained by certain parameters (the resolution, time limits, etc.), that persuades a judge or judges more than your opponent's argument does. Convince the judge(s) and you win. As a debater, you must provide the best argument for *that* judge. Be sure to keep track of judges' preferences regarding not only arguments, but style. Remember, according to the rules of the game, the judge is always correct.

Take seriously the judge's critique. Whether providing an oral or written critique, every judge deserves your attention. Judges' comments often contain valuable insights on improving your speaking style and on what lines of argument were the strongest or weakest. In addition, taking seriously the judge's critique prepares you for future rounds when you may have the same judge.

Strive to develop your arguments fully. As the debate progresses, so too should the arguments. Debates are not about tag lines, but about reasons. To convince a judge, you must *explain* you position, not just state it. Each claim you make should be an argument motivated by substantive reasons, not merely the conclusion to an argument. Moreover, you should dispute arguments, not tag lines. Explain the fallacy in your opponent's reasoning. Simply denying that something is the case, without providing a justification, does not constitute a compelling position.

Spread out your flow. If your flowsheet is confused, you will look confused, your argument will be confused, and you may confuse the judge. Make the progression of your arguments clear; leave more space between arguments than you think you need. Don't be afraid to use lots of paper.

File your cards immediately after the round. Never assume that you won't need evidence from the last round in your next round. If the cards you need are lost somewhere in the abyss created by not filing, you'll squander precious prep time in a frenzied panic as you dig for the evidence.

Always keep in mind the big picture. Throughout a debate, you must make choices about which arguments to push and which to let go. Selectively emphasizing arguments that you are winning or don't want to lose is absolutely essential. As the speech times shorten and the arguments broaden, something must give. If you don't consolidate your positions, you will leave the judge to draw her own conclusions about the significant issues in the round. Instead, shape the judge's decision-making process so that a ballot in your favor is the only choice.

***Carlos Rodriguez** received a bachelor's degree in the School of Foreign Service at Georgetown University, where he was a member of the NDT debate team, and a master's degree in philosophy from Johns Hopkins University. Now a program coordinator at CTY, Carlos has also taught debate at the National Debate Institute.*

Creative Minds Imagine

Green

by Stephany Ota

Green is calm and quiet
Humbly peacefully resting in a deep but warm forest.
Bright green frogs hopping from lilypad to lilypad,
Sweet-smelling grass,
Mother Nature and her mysterious ways,
Turtles with their callused skin and mossy shells hard as rocks
The intelligent son of soothing blue and energetic yellow,
The rolling hills and meadows of a vast plain, enveloped by wilderness.
Shadowy seaweed at the bottom of the murky ocean,
A cactus with an abundant supply of water,
Only loud when screaming, GO at waiting cars,
An ancient Chinese dragon
Or a caterpillar,
A grasshopper,
Or a sour apple.
A peacemaker in the midst of war.
Green is a sleeping alligator ferocious yet tranquil,
Warmth and happiness,
Spring and summer blended together to make ice cream colored light green,
A watermelon rind picked clean of any last fragment of red.
In a song, green is the chorus, important but not appreciated enough;
In a play, green is the prop maker and the costume designer.
New and alive, representing rebirth,
Green fixes and makes things anew.
The comforting warmth that covers a cold, worried body,
Fresh leaves as they spring from branches.

Green.

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Knossos Games

by Tim Boester

Here's a puzzle inspired by proteins that mediate transport of materials between cells.

The Goal:

By moving the asterisk, maneuver all the filled circles into receptors (open circles).

The Rules:

You control the asterisk. The only way to move within this cellular maze is via the facilitated transport systems (arrows). Like their real-life counterparts, these transporters facilitate movement of substances according to certain rules:

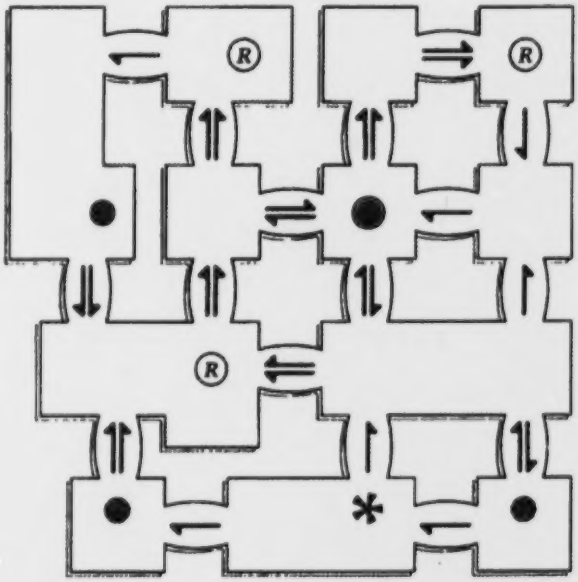
- ***Uniport*** systems allow one-way movement only. In the puzzle, uniporters serve as one-way doors for the asterisk.
- ***Symport*** systems allow a substance to pass only if accompanied by a partner. You can move using a symporter only if a filled circle moves with you.
- ***Antiport*** systems allow a substance to enter the cell only if another leaves. You can move using an antiporter only if a filled circle moves opposite you.

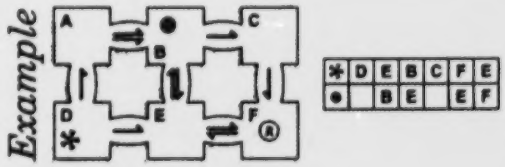
- The filled circles can only move in conjunction with the asterisk; they cannot move alone.
- Only the asterisk and filled circles move from cell to cell; the receptors do not move.
- One filled circle is already in a receptor, but you may need to move it in order to get the rest of the filled circles into cells with receptors.

You have completed the puzzle when all the filled circles are in receptors.

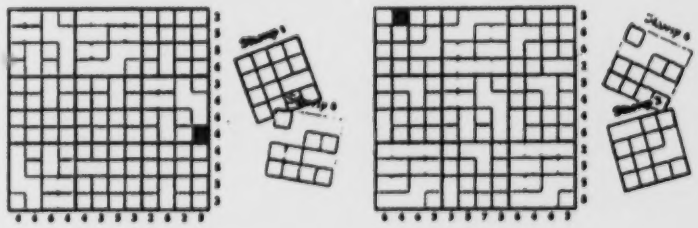
The example shows an asterisk maneuvering a filled circle into a receptor in four moves.

A graduate student in educational psychology at the University of Wisconsin, Tim Boester now has additional puzzles on his home page: http://homepage.mac.com/boester





Solution to Knossos Games in our November/December issue:



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ImaGiNe

PPORTUNITIES AND RESOURCES FOR ACADEMICALLY TALENTED YOUTH

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Focus on Medicine & Health Sciences

On the Wild Side of Veterinary Medicine

A Doctor Without Borders

BS/MD Programs

Students Review Brown University

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Imagine...

*Opportunities and Resources for Academically Talented Youth**

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Center for Talented Youth

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Editor	Melissa Hartman
Assistant Editor	Michelle Burkhart
SET Director	Linda E. Brody, Ed.D.
Research Associate	Carol C. Blackburn, Ph.D.
Editorial Assistant	Vicki Moore
Student Assistant	Aaron Beck
Designer	Tempest Design Group

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Address editorial correspondence to:
Melissa Hartman
SET/CTY
The Johns Hopkins University
3400 North Charles Street
Baltimore, Maryland 21218
(410) 516-0309 • fax: (410) 516-0108
e-mail: mhartman@jhu.edu

ANNOUNCEMENTS

Join *Imagine's* Readers Panel

Help make *Imagine* the best magazine for teens like you! We're forming the Readers Panel for the 2001-2002 volume year, and we want to hear from you! The Readers Panel is made up of student readers who provide feedback to the editorial staff on each issue and ideas for topics to cover. Some of the stories in this issue were suggested by members of our current Readers Panel.

If you want to join our Readers Panel, submit a paragraph critiquing this issue of *Imagine*—the editorial content, the design—or offering your general impressions. Be sure to include your age, grade, and address. We'll choose 6-10 readers to be on the panel. Mail your paragraph to Michelle Burkhart, SET/CTY, 3400 North Charles Street, Baltimore, MD 21218 or send her an e-mail at miburkha@jhu.edu

Creative Minds Needed

We are seeking submissions for the "Creative Minds Imagine" and "Off the Shelf" sections of *Imagine*. If you have a good book that you would like to review, let us know. If you have creative work that you would like us to consider, send your submission to Melissa Hartman, SET/CTY, 3400 North Charles Street, Baltimore, MD 21218 or send her an e-mail at mhartman@jhu.edu

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The Joys of Competition (Stanford)
Planetary Science (University of Texas)
Writing for Publication (Carleton)
Computer Technology (Georgetown)
The Social Sciences (Johns Hopkins)

Volume 6
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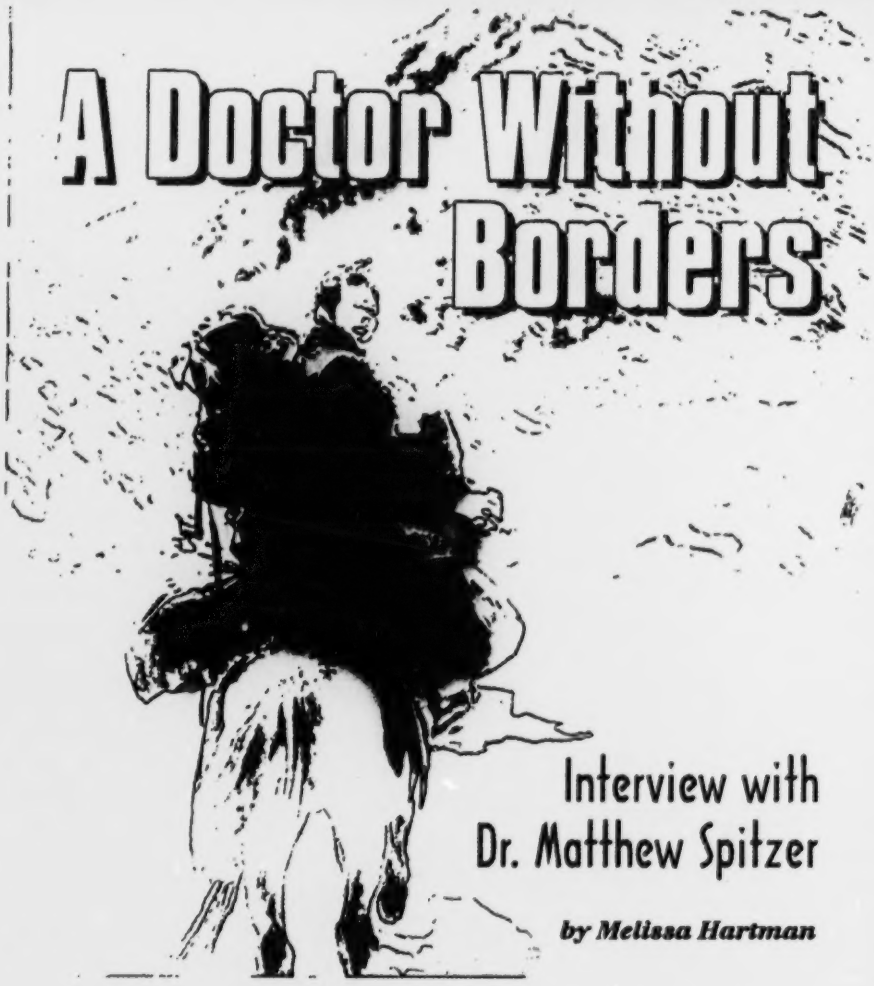
A Doctor Without Borders



Interview with Dr. Matthew Spitzer

by Melissa Hartman

As an emergency physician and family doctor in several California hospitals and free clinics, Dr. Matthew Spitzer spends much of his time caring for rural, immigrant, and other underserved populations. In the fall of 1999, as a volunteer physician for Médecins Sans Frontières (Doctors Without Borders), he took these experiences abroad. On his nine-month mission to Tibet, Dr. Spitzer opened a health clinic where he not only treated patients but also provided training to local doctors.

Did you go to medical school with the intention of helping underserved populations?
Definitely. I was raised to have a social conscience, to pay attention to what was going on in the world around me. I knew that I would work with underserved populations in some way. I made the decision to go to medical school much later, when it came time to decide what skill I wanted to bring to these populations. My main reason for going to medical school was to acquire a skill that I could contribute.

Why did you want to work with these populations in particular?
I am very interested in the diversity of cultures. Practicing medicine in a cross-cultural way, with groups of people whose rules and societies and customs differ so much, gives me amazing access to these cultures. And I mean culture in the broadest sense of the word. Here in downtown San Francisco, we serve a lot of drug users and transgender people, for example, and those groups are really whole cultures in themselves.

But I especially enjoy the challenge of working with immigrant populations. In working with immigrant patients, you have to listen differently. The more familiar the people you're working with, the less it seems that you need to pay attention to certain things. It can be challenging to relate to people whose situations and experiences are so different, but I enjoy stepping into other cultures and exploring and being open to doing my work in different ways.

Is that what led you to apply to Médecins Sans Frontières (MSF)?
Yes. And in my international work so far with MSF, I've found that the skills I use are similar to those I use here at home.

How does one become an MSF doctor?
You fill out an application. You include your résumé and explain why you want to be an MSF doctor. Then you're invited for an interview, where you talk to an experienced MSF volunteer, someone who's been on a lot of missions, who explains in more detail what they're looking for. If they accept you, they put you on an active list and give you a call when something appropriate comes up.

I took the first one I was offered, to Tibet.

How was it determined that you would go to Tibet?
They were looking for different skills than they look for on typical emergency missions. They wanted some teaching experience, for example. They wanted someone who was able to commit to more time than doctors spend on emergency missions, and they wanted someone who was willing to work in a pretty isolated area. I had teaching experience, had done a year of work in rural areas, and had done some traveling in the area before, so I think I was a good fit.

Some of the places MSF sends doctors are very isolated; some are very dangerous. Did you have any apprehensions when you applied?
When they call you with a mission, you can accept it or not. You're free to say that you don't feel comfortable going into a certain situation.

I felt that the mission to Tibet would be a good first mission. I wanted to be able to do some work in a place where security issues wouldn't prevent me from doing what I'd come there to do. I saw this mission as a chance to get my sea legs.

But the less acute a situation is, the more long-term it will be and probably the smaller the team assigned to it will be. For most of the mission, I was the only medical person there. I had a lot less guidance than I expected.

Did you have any training before you went, say, in language skills?
In general, language training isn't offered, and it wouldn't have helped much where I was anyway. The people in Jiqu speak a regional dialect of Tibetan, so even if I spoke fabulous standard Tibetan, I wouldn't have been able to understand what the villagers were saying.

I assume you worked a lot with a translator.
Yes, a lot. In the nine months I was there, I learned a fair number of basic medical terms, but most of my work was done with a translator.

It helped that much of the work I'd done in the States was done in translation. During my residency I worked in a refugee clinic where I saw a lot of Vietnamese, Cambodian, and Russian immigrants. That definitely made the project easier for me.

What was the purpose of the mission to Tibet?
The mission was to open a teaching clinic in Jiqu. The clinic was to be used both as a medical treatment center for the local people and as a teaching center, where we would offer practical hands-on teaching to some of the local doctors.

It had started to some extent between 1995 and 1997, when MSF had been in the area for food relief. This area had previously been closed even to MSF, so they used this opportunity to do an assessment of the state of the rural health system in China. It used to be one of the best systems in the world, but by the 1990s it had pretty much disintegrated.

What did you do first when you got there?
By the time I got there, MSF had located a site, got the building working, and found us places to live, but I still had to do a lot of preliminary work. I had to develop relationships with local officials and physicians, for example.

A couple of teams before me had tried to do some teaching, but it was really didactic teaching. They offered training courses to large groups of local doctors. The local people didn't understand why the doctor wasn't treating patients or giving medicines to people, so part of my work was re-explaining what we were trying to do.

How did you approach training the local doctors?
We saw patients in the clinic with the local doctors. We'd model the way we do a physical exam and the appropriate use of Western medicines. It was case-based learning—what you do for this patient, how you approach this particular illness. It's like the way a resident works with an intern or a medical student here in the States, so it's not so different from the work I do now.

Did you see any kinds of cases there that you wouldn't see here?
Because of the cold and the altitude, there aren't a lot of communicable diseases or parasitic infections; it was more bread-and-butter medicine, just the basics. Sometimes, though, we treated things that a typical family doctor wouldn't see—we treated someone who fell off a cliff, for example.

Can you tell us a little about that case?
That was interesting for a few reasons, including the way we found out about the patient. A shopkeeper we already had a relationship with came to see us. He sat down, we had tea, we chatted a bit, and then he told us the story of a girl who had fallen off a cliff. It took about a half-hour for him to help us understand that the story wasn't in the distant past. His excessive politeness prevented him from saying directly that the young woman was related to him, that this had just happened, and that he wanted us to come see if we could help her.

Were you able to help her?
It was luck that she was even still alive when we got there, that she didn't break her neck in the fall. We think she fell about 25 feet, and she landed on her head. We closed her wounds, gave her some fluids, and gave her antibiotics and explained to her family

how to administer them. And she survived.

We couldn't do sophisticated tests to determine how fully she'd recovered neurologically or psychologically. But we could assess whether she was able to do the activities of normal life, whether she was conversing normally with others, whether her life was like it normally would have been. And it was, pretty much. She wasn't herding yaks like she was before, but she was doing the chores around the house and walking and talking normally.

Tibetan doctors rely heavily on herbal medicines. How did your teaching fit with their traditional approach?
I think of it as complementary. I think Western medicine is clearly superior at treating some things, like acute infections and acute diseases, because it can specifically target problems and eradicate them.

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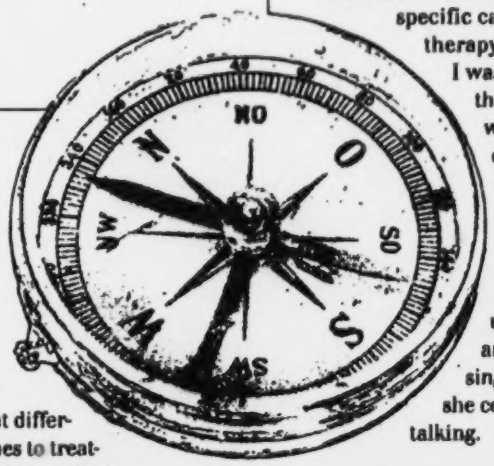
Discovering Possibilities with Medical Explorers



by Amanda Cheung

Medical Explorers: the name itself depicts a journey full of adventures and new experiences. This program is offered by my school to students who think they might be interested in entering the medical field. Already considering a career in medicine, I joined this group, hoping that the program would show me some of the possibilities within the profession and help me narrow my choices.

The group met once a month for a few hours. At each meeting, we learned about a new topic from a speaker who worked in that field. The speakers would offer a presentation and occasionally a tour of the places where they worked.

One of the speakers was a surgeon at a local hospital. He showed us a video of a few different operations, including a kidney transplant that he had performed earlier that day. This gave us a clear picture of what surgery is really like. Although I was impressed by the technology that recorded what was happening inside the patient's body, seeing these operations pretty much confirmed my suspicion that surgery is not the field for me to pursue. This session also included a tour of the hospital. I especially enjoyed seeing the Emergency Room—all of the equipment we saw gave us a sense of the anxiety and trauma that must take place there every day.

In another meeting, we learned about different approaches to treating epilepsy. A neurologist whose work focuses on epilepsy showed us what appeared to be a flat, round battery. It was actually part of a treatment called vagus nerve stimulation, in which this disc is implanted in the chest wall. Electrodes are wound around the vagus nerve, and the battery is programmed to send electrical currents at set times in order to prevent seizures. I was also suprised to learn that a ketogenic diet may help children with certain kinds of epilepsy. Composed mainly of fats and little protein or carbohydrates, this diet is often able to either control or reduce the frequency of seizures. In another interesting part of this meeting, we learned what to do when someone is having a seizure: it is best to allow the jerking movements to continue, because an attempt to restrain or apply pressure may tear a muscle or break a bone. The important thing is to clear the area of objects that could fall or otherwise injure the patient.

While I learned a lot from all of the meetings, I most enjoyed the session on music therapy. This field appeals strongly to me because I have a passion for both music and the sciences. The presenter at this meeting demonstrated several ways in which music therapists interact with the patients, including singing, listening to music, and playing instruments. People who are otherwise unable to communicate often find ways to convey their thoughts and feelings through music, and this therapy has helped people with autism, Alzheimer's disease, Parkinson's disease, depression, anxiety, and chronic pain, among other disorders. We learned about several specific cases in which music therapy had been effective. I was most affected by the case of a teenager who had become suicidal after her parents and siblings died in a car accident. She was admitted to a special high school that used music therapy, and she was able to sing about the pain that she couldn't express by talking.

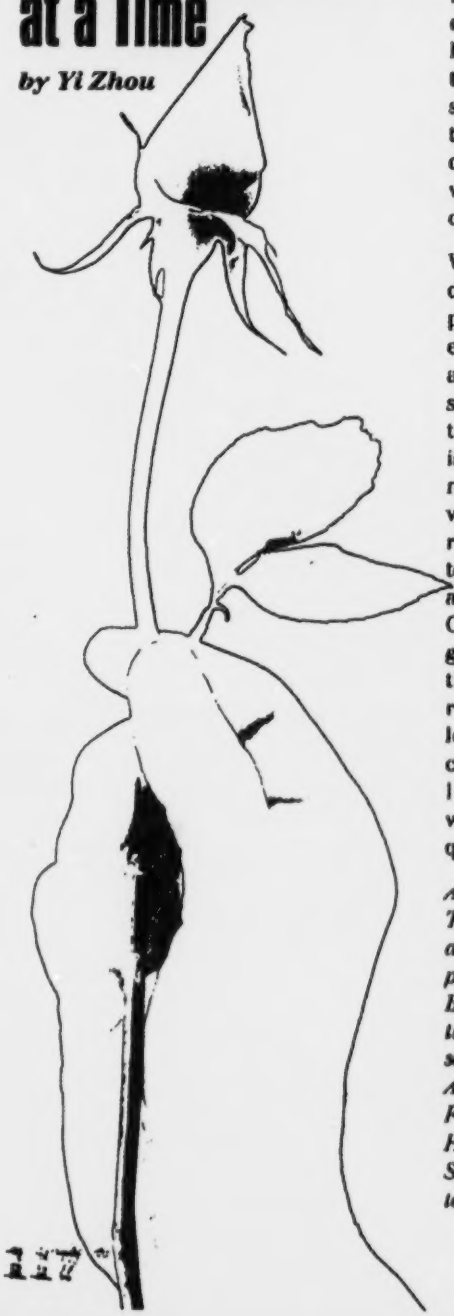
Although I am still uncertain about which specific area I want to go into, Medical Explorers has made me certain that the medical field is the right one for me. This program exposed me to many possibilities that I wouldn't have discovered on my own. I definitely benefited from attending every meeting. Now I'll take what I've learned and continue exploring until I find the right area for me.

*A junior in the I.B. program at Southside High School in South Carolina, **Amanda Cheung** holds leadership positions in several service clubs and is a member of numerous math and science clubs. Amanda plans to pursue a degree in engineering before attending medical school.*

Improving Patients' Lives

One Small Gesture at a Time

by Yi Zhou



Many people from all over the world come to M.D. Anderson Cancer Center in Houston, Texas, to seek treatments because they know that they will receive excellent care here. I, on the other hand, came here as a volunteer because I knew that I would gain experience that will someday make me a better doctor.

Since I joined the team of over 1,500 volunteers three years ago, I have gained many new friends and skills. Because Volunteer Services provides such a wide variety of services to patients—from operating a Business Center with computers, fax machines, and xerox machines to delivering newspapers—volunteers have choices as to what they would like to do. I have volunteered in several areas, and all of them have improved how I interact with people.

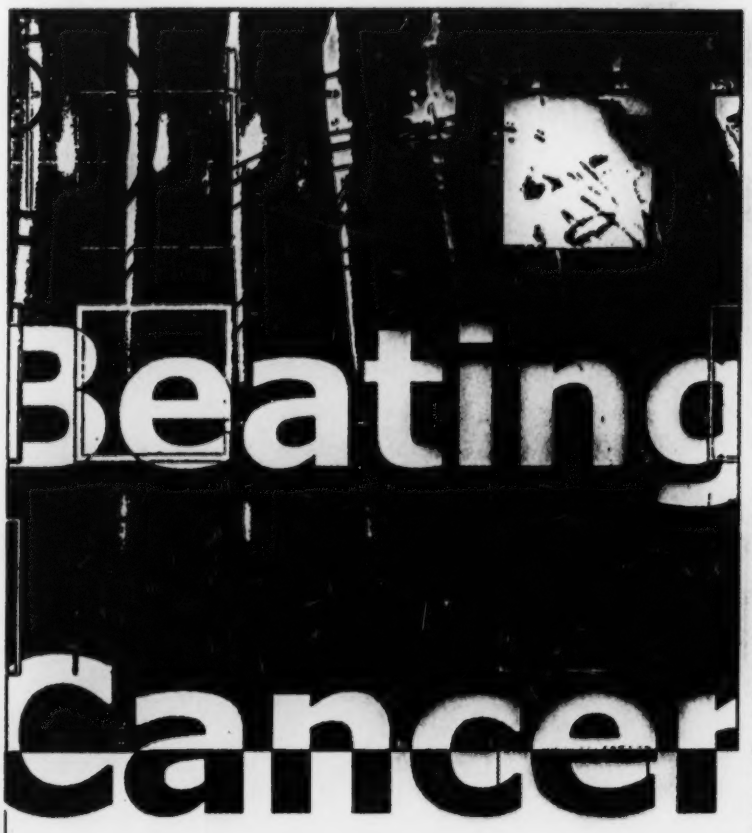
I have enjoyed working in the gift shops run by Volunteer Services, and even had the responsibility of running the cash register at age 13, a few years before I would be applying for jobs. Another job I really like is taking the movie cart, which has a great selection of current and classic movies, to patient rooms. Time can pass slowly when you're in the hospital, and the patients seem to appreciate the diversion these movies provide. And I always like the interaction I have with the patients.

Probably my favorite job is floor hosting. Each day, Volunteer Services tries to make sure that every patient room on every floor is visited. Volunteers usually go around in pairs checking to see if patients need anything. At first, I felt like a door-to-door salesperson. Another volunteer and I visited patient rooms, offering our products at each one. "Is there anything we can get you today? Any toiletries? Crocheted slippers? How about crossword puzzles or embroidery patterns? We've also got magazines, and do you know about the Business Center?" As I became more experienced at floor hosting, though, I realized that even this simple gesture can make a big difference to the patients.

In addition to the organized services we provide, we also have to be ready when a patient just wants to talk. That's why I attended a workshop designed to help volunteers better communicate and empathize with the patients. I learned an amazing amount about the art of listening. For example, I realized that often in conversation, when one person is searching for a particular word to use, the other person naturally tries to supply the word. However, I learned that when listening to patients, it is better to allow them to find their own words because they need to know that they are still able to do things for themselves. Although I haven't yet had much practice with these new communication skills, I can see how they are important for doctors to have. I hope that when I become a doctor, patients will see me as a person who is willing to listen, someone they can talk to freely.

Volunteering at M.D. Anderson has definitely firmed up my decision to pursue a career in medicine. My parents both work in the medical field, and I have always been fascinated by science and the human body in particular. But now I know that medicine is more than treating illness. I love making the patients smile. I love it when I hear them say, "Oh, I don't really need anything. I'm going home today." In fact, I love every aspect about volunteering at M.D. Anderson Cancer Center. I love the numerous gardens outside and the indoor terrace that provides a place of serenity and rest to patients and their visitors. I love finding my way around the color-coded zones. But, above all else, I love meeting new people, working with them, and trying to make their quality of life better.

*A tenth-grader at Bellaire High School in Texas, **Yi Zhou** is active in Mu Alpha Theta, the Bellaire International Students Association, debate, Antares, and the French National Honor Society. She hopes someday to be a surgeon.*



the patient's side...

by Kelsey Innis

The scar is tiny, a jagged V, no bigger than my thumbnail. It's barely there now, a little whiter than the rest of my skin, raised a little higher. It is about six inches above my bellybutton, never visible, just my little secret.

I've had it since December 1, 1994. That was a Thursday. My dad's 33rd birthday. Which, in 1994, fell exactly one week after Thanksgiving. That year we drove up to my grandparents' house at Lake Tahoe for Thanksgiving. It became immediately obvious to my entire family that there was something wrong with me when I slept through Thanksgiving dinner. About the only thing my father's family appreciates more than sleep is Grandpa's roast beast. I was sick.

Thanksgiving Weekend, 1994

Thanksgiving weekend of 1994 will always be memorable to us, for better or worse. For other people it was memorable because Tahoe was hit with a big snowstorm. My parents were stuck with four feet of snowfall, a sick eight-year-old, and a 1991 Toyota Tercel that would never make it back to San Francisco, no matter how long my dad wrestled with the chains. My grandparents had to lend us their huge sports utility vehicle to drive the 350 miles back home.

We finally arrived home on Saturday morning. Because the pediatrician's office is closed on weekends, we had to go to the center where patients are referred after hours. By the time we got there, my belly was full of fire and I was starting to turn a fine shade of yellow.

The doctor on call there took one look at my jaundiced eyes and skin and diagnosed me with hepatitis. My father was immediately sent to Walgreens for rubber gloves and disinfectant to remove all traces of the highly contagious disease from any exposed surfaces in the house. My mother was assigned the task of calling the parents of my infant cousins and explaining to them how I had inadvertently exposed their fragile immune systems to a potentially fatal disease. While my parents were absorbed with their tasks, I draped myself over my dad's easy chair and fell into an uncomfortable, fitful sleep.

My mother, in a mighty show of maternal instinct, sensed that something else was wrong and called the pediatrician. She was right—hepatitis is not usually accompanied by unbearable abdominal pain. The pediatrician decided he needed a good look at me himself. On the way to his office, I spewed purple popsicle all over the interior of my grandparents' car, which was especially unpleasant considering we thought I might have a very contagious disease.

The office was dark and empty. After giving me a thorough and rather painful examination, the doctor decided

that it would be best to get a sonogram of my stomach.

The sonogram went relatively well; the technician was very kind and gentle. When she was finished, she paged the radiologist. He entered the room, took one look at the screen, and announced, "I'm not going to keep you in the dark. Your daughter has a huge tumor from her pelvis to her chest. She's going to need to be admitted to the hospital for tests." Generally, that's not how you break the news to the parents. The man wasn't lying, though; I'll give him that much.

I was admitted that night and they put an IV into my hand. The nurses hung a bag of fluids to the pole and put a shot of morphine in the tubing. I was close to dehydration and I was in screaming pain. My parents spent the rest of the holiday weekend in shock. I spent it in a haze of morphine hallucinations and constant discomfort.

The Treatment

The following Tuesday they wheeled me into surgery and began work. They had to poke me several times, the biopsy man reported to my parents later. The tumor was like "tapioca pudding." Once that was done, someone threaded a rubber tube into my main artery, leaving the ends exposed, flapping in the wind, accessible to anyone and anything wanting a free ride inside my inner workings.

Later that day they came back with a verdict: Burkitt's lymphoma. They were almost excited—my mom swears she saw the interns high-fiving each other in back. It's rare, only a few cases a year in the United States. The fastest growing cancer in the world. Doubles in size every 36 hours. They had installed a Broviac, a catheter, into my chest so that they wouldn't have to poke me every time they needed to do a test.

"Burkitt's lymphoma," my mom would carefully pronounce during those first few weeks. "Broviac." She had a tendency to say "Bouvier," Jacqueline Kennedy Onassis's maiden name. Jackie O died a few years later of another type of non-Hodgkin's lymphoma, a slow growing type.

I was lucky, they said. Chemotherapy works by catching cells when they are dividing. Since my tumor grew so fast, it was easy to kill with drugs. There would be no radiation or surgery necessary—just straight into chemo. And the chemo would take only six months. They just had to be sure first, which meant a barrage of tests. CT scans, all manner of blood draws to make sure that my emaciated, doped-up body was ready for the high doses of lethal drugs they were preparing to pour into me.

I started treatment in intensive care on December 2, 1994, the day after my biopsy. They kept me in PICU for three days and then moved me to transitional care. Much of the tumor mass was gone by now and they reduced the amount of morphine I was on. As a result, I realized where I was and became depressed. The one thing I lived for was Hanukkah. Every night my great-aunt would come and light the candles, and I would get to open one of eight presents that my grandmother sent.

I was released for the weekend of the 9th, but I had to come in for blood work on both days, and on Monday I was readmitted for a new chemotherapy cycle. For the next four months I lived like this, from weekend to weekend.

And Now, The Good News

Late in March of 1995, one of my doctors came into the hospital room for rounds. He checked up on me, and then, as he was leaving, casually dropped, "Oh, and did Dr. Wilbur tell you that this will be your last chemo round?" He was grinning from ear to ear; obviously, he knew that Dr. Wilbur hadn't told us. My mom started weeping for joy. I finished chemo two months early, on March 31st.

I have been cancer-free since then. The oncology checkups have gotten fewer and farther between, going from every other day to a year apart. After a year of being off treatment without relapse, I was considered cured. 99.9% of Burkitt's lymphoma patients stay completely in remission if there is no relapse after the first year. I celebrated my five-year anniversary of being off chemotherapy last March: I bleached and dyed my hair. I plan to skydive for my tenth anniversary. Doctors have never seen a case of relapse in Burkitt's lymphoma patients after five years.

It was difficult to discover, at age eight, that my parents couldn't protect me from everything. But cancer has given me a better sense of my own mortality than the average teenager has. This scar has prevented me from making so many stupid mistakes that I would kiss it if I could bend that way.

Cancer has taught me that life is worth living because there may be no other chance to stay up all night for no good reason, no other chance to let music or words or pictures sink deep enough into your soul to make you cry, no other chance to be full to the brim of rebellion, revolt, and righteousness. Cancer has taught me to go out and grab life by the coattails and give it a good shake, to experience existence in all its blazing glory.

I have met so many children with cancer who will never have the chance to live this way. You have the chance. And, thankfully, so do I.

***Kelsey Innis**, 14, is a freshman at Lick Wilmerding High School (the name makes her laugh, too) in San Francisco. Kelsey is on the crew team, plays tenor saxophone, and rejoices in wearing her pajamas in public.*

Nursing

THE (Unexpectedly) PERFECT CAREER FOR ME

by Bronwen Dean, R.N.

There I sat, only two months before my college graduation, and the biggest decision of my life lay before me: would I be a nurse or a doctor? My whole life I had said I wanted to be a doctor, and, at the time, I had some of the same thoughts about nursing as many people do: Who wants to clean bedpans, give shots, and follow doctors' orders all day long? My application to nursing school was actually just a backup. I thought, *if I don't get into medical school, I'll go to nursing school for one year and then reapply to medical school. Nursing school will be easy, and I will get some good medical experience along the way.* What a great plan I had come up with!

Although I was accepted to nursing school, I didn't really think I would have to go there. When I finally received my rejection letter from medical school, I sat on my bed and cried.

Soon I was off—grudgingly—to a new city to start my year of killing time. But my first semester of classes at nursing school spun my head around. On the first day, everyone else in the classroom was so happy to be there because getting into the nursing program had been really difficult. I, on the other hand, had no idea that admissions to four-year nursing programs are so competitive. Only 60 out of 500 people were accepted to my program. I was one of the lucky few and didn't even know it until now.

As the weeks went on, I realized not only how difficult nursing school was, but also how many different options I had as a nurse. I could go on to pursue a master's degree, or even a Ph.D. in nursing, and could pursue a research career with either of those degrees. I could go on to work in any one of hundreds of highly specialized fields. I could work in a hospital, a doctor's office, a health clinic, or a school. I could work at DuPont or John Deere as an occupational health nurse, taking care of people injured on the job. I could become a traveling nurse and work in private homes. Ultimately, I decided to be a labor and delivery (L&D) nurse in a hospital.

Labor and delivery is a very intense area to work in and is not for every nurse. At my hospital, L&D nurses work one-on-one with a family once they are admitted, so we form very strong bonds with families in a very short time. I have to do everything I can to make sure that the mother is as comfortable as she can be, and I have to make sure that the baby is tolerating labor well. Although most mothers have a normal delivery and end up with a healthy baby, I have to be ready at all times for something to go wrong and to be able to respond quickly. And I have to remain calm even in crisis situations so that I don't alarm the family. All of this makes for an extremely challenging workplace, but being part of the moment when a baby is born is indescribable. That one moment makes every long, hard day worth it.

I never reapplied to medical school. First of all, I realized that nursing school was at least as challenging as I thought medical school would be. I learned not only how to diagnose and cure disease, but also how focus on the whole person, mind, body, and spirit. Second, while I was in nursing school, I had the opportunity to talk to many doctors who found that the hospital had become their life, leaving little time for family and friends. Nursing, on the other hand, allows me to work in the medical field as I have always wanted to do while leaving me plenty of time for my family and social life. In addition, my job gives me a lot of time to focus on patients—I often devote all day to a single patient. As a doctor, I would have many patients to see and probably would not be able to give them the individual attention I can give them as a nurse.

I love what I do, and I have never looked back. Getting rejected from medical school turned out to be the best thing that ever happened to me.

*An L&D nurse at St. Luke's Hospital in Cedar Rapids, IA, **Bronwen Dean** earned a B.S. in biology from Iowa State University and a B.S. in nursing from the University of Iowa. Bronwen spends her free time reading, swimming, and traveling. This summer, she and her husband will travel to Sweden and Spain.*

a perspective

on the HPME program at Northwestern University

by Jeremy D. Collins

A little more than five years ago I embarked on a journey through piles of mail, searching for the right undergraduate program to suit my needs. During my search, I came across combined B.S./M.D. programs that sounded interesting. With the promise of admission to both an undergraduate university and an associated medical school, they just seemed too good to be true. I narrowed my choices down to engineering or a combined program and applied to several types of programs. After receiving news of admission to both B.S. only and B.S./M.D. programs, I had to make some tough decisions.

I decided to attend a combined program because I love the technology of medicine. I find solving problems as they arise in the human body intriguing. However, I felt that engineering could be interesting as well. The discovery of a combined program allowing a degree in engineering was instrumental in making the final decision.

I chose to attend the Honors Program in Medical Education (HPME) at Northwestern University (NU) in Evanston, Illinois. HPME is a seven-year combined program involving both the undergraduate campus and the Northwestern University Medical School (NUMS).

While applying to colleges, I realized that it was difficult to evaluate undergraduate campuses and medical schools at the same time. I found myself having to rely on the opinions of others. I also knew that curricular and other changes could occur in the three or four years before I'd be attending medical school. These realizations, coupled with the fact that many of the combined degree programs allow students to apply to other medical schools, convinced me to base my decision predominantly on the undergraduate experience. As I enrolled in the HPME program, I reassured myself that I still had the gamut of medical schools open to me if I decided to apply elsewhere.

When I arrived at NU, I was particularly impressed with the flexibility of the HPME program. I had the option to enroll in the School of Speech, the College of Arts and Sciences, or the Engineering School. And the course load allowed for more flexibility as well. Some of the other combined- degree programs I looked at attempt to cram four years of coursework into two or three years of attendance. During the three years I spent pursuing a B.S. in medical engineering at NU, however, my course loads were similar to those of other students.

With certainty of admission to NUMS after graduation, I found that I could focus on other pursuits during the undergraduate program that I would not have had time for if I was busy preparing to apply to medical school. I did not even have to take the Medical College Admission Test. I also found taking exams in biology and chemistry much less stressful knowing that I was not competing with classmates for admission to medical school.

Through the HPME program, I was offered the option of delaying the start of medical school either to pursue other interests or to take an additional year of classes. I felt encouraged that the door was still open if I were to change my mind about medical school.

Fortunately, I stuck with it. After graduation, I traveled 40 minutes to the Chicago campus where NUMS is located to begin the fourth year of the program. I am currently in the fifth year—which is the second year of medical school—preparing to spend the next two years on the hospital wards. Now that I am in the medical school, I can definitely say that I have chosen the right field.

From my experience with the HPME program, I recommend that anyone who has a strong interest in medicine entertain the possibility of applying to combined B.S./M.D. programs. Although I definitely enjoyed dabbling in engineering the first couple years of the program, I now know for certain that my calling is medicine.

Jeremy Collins hopes to become a radiologist in the Chicago area. He enjoys weight training, basketball, baseball, and football.

For more information on combined B.S./M.D. programs, please see this issue's "Planning Ahead for College" article on page 31.

Better Medicine: Trends in Health Science

by Carol Blackburn

The health sciences are entering a golden age—a period of unprecedented growth, both in basic knowledge about how life works and in tools to prevent or treat diseases. Whether you plan to be a health care practitioner, researcher, or just a patient in the decades ahead, you will benefit from developments in medicine and health sciences. Here's a brief look at a few of the innovations that are making medicine better.

Molecular Medicine

Genetics and genomic research will revolutionize medicine, providing a greater understanding of health and disease and opening up new possibilities for prevention and treatment. The process of identifying genetic variations within the human genome and correlating such variations with disease susceptibility is already underway. Genetic screening is available for some conditions in which heredity plays a dominant role, such as Huntington's disease and certain cancers. As researchers learn more about the genetic factors that increase the risk of developing various conditions, doctors and patients will be better able to anticipate potential health problems and take steps to avert them or catch them early on.

Understanding diseases at the molecular level—identifying the molecules that malfunction in particular diseases—will make it easier to design therapies that directly target the problem. The pharmaceuticals in use today act at only about 500 out of an estimated 5,000 potential sites that might be good targets for treatment, leaving lots of room for discovery.

Some of tomorrow's therapeutic agents will be substances the body produces naturally—hormones, growth factors, antibodies, RNA, and DNA—that can be given to supplement insufficient production (as insulin is given to diabetics) or to enhance a natural process. Research will identify more ways to stimulate the body with its own molecules, and biotechnology will make it possible to produce therapeutic amounts of them.

Molecules that are not native to the human body—drugs—will also continue to be an important part of the pharmacopoeia, and a complex one. Patients do not always respond to drugs the way doctors expect they will. Individuals vary in their responses to a drug for many reasons. They may differ in the precise structure of the target molecule—the site where the drug is designed to act. They may differ in the number or nature of unintended "off target" sites where the drug also acts. And they may differ in the way the drug is metabolized by the body. All of these facets of drug action are regulated by genes.

The challenge of choosing the right drug is further complicated by the fact that diagnostic categories may include patients with different underlying problems. Research on the factors that underlie diseases will identify relevant genetic variations and will enable doctors to tailor the treatment to the patient's particular problem. Today, doctors and patients must often undergo a frustrating trial and error process to determine which drug works best for a particular patient. Tomorrow, genetic screening may help doctors choose the best drug on the first try.

Pharmacogenomics—the study of how an individual's genetic makeup affects the body's response to drugs—is important not only in choosing appropriate drugs for particular conditions and individuals, but also in identifying drugs that are inappropriate for a given patient. Today, 100,000 people die every year in the United States as a result of adverse drug reactions. In the future, that number will drop. Many adverse reactions are the result of the way a drug is metabolized by an individual. Hundreds of enzymes participate in the metabolism and clearance of drugs from the body. Some patients' enzymatic arrays metabolize particular drugs more quickly than do others, and some create toxic metabolites, while others do not. As more is learned about drug metabolism, it will become feasible to define the genetic profiles of people who can and cannot safely take particular drugs. And when drugs are prescribed, the current method of computing drug dosages on the basis of weight and age will be replaced by one based on genetic and metabolic profiles.

Imaging Technologies

While genes allow doctors to look noninvasively into a patient's biochemistry and physiology, imaging technologies allow them to view internal structures and functions non-invasively. Already a vital part of medicine's high-tech diagnostic toolkit, radiology will continue to evolve as both a diagnostic and a therapeutic technology.

The National Library of Medicine (NLM) has created the first complete, full-body radiologic database of a healthy man and woman. The bodies for the Visible Human Project were scanned from head to toe using both computerized tomography (CT) and magnetic resonance (MR) imaging. Imaging software converts these 2-D scans into a 3-D virtual environment in which viewers can move around and explore. Medical students can practice surgical procedures on a virtual body before they test their fledgling skills on the real

thing (an innovation that will make patients at teaching hospitals rest easier!). The NLM plans to make their model patients modifiable, so students can practice on bodies of all shapes and sizes.

Software that transforms 2-D scans into a 3-D image is an aid to surgeons as well as students. 3-D images rendered from scans of an actual patient can help surgeons visualize their target clearly and plan their approach. But 3-D images can be more than just previews; with the right software, they can form the basis for computer simulations of procedures under consideration. Charles Taylor, a Stanford University mechanical engineer, is perfecting an innovative software program called ASPIRE—Advanced Surgical Planning Interactive Research Environment—that will allow surgeons to model different surgical options: to try out, for example, different placements of a coronary artery bypass graft, then run a fluid dynamics simulation to see which option achieves the most improved blood flow for that patient. Taylor's program takes into account not only structural features revealed by radiologic imaging, like the patient's coronary artery structure and pattern of blockage, but other features that affect blood flow, such as blood pressure, viscosity, and heart rate. This sort of modeling, using physiological data from a patient to predict the outcome of a given procedure on that patient, is a model for the future.

Other imaging enthusiasts, like Harvard Medical School's surgeon-turned-radiologist Ferenc Jolenz, are paving the way for the day when some surgeries will be replaced by interventional ultrasound or MR procedures. Unlike the radiation currently used in cancer treatments, the energy frequencies used in ultrasound and MR do not damage tissues they pass through. Highly focused ultrasonic energy creates heat at the focal point, and is already being used to destroy benign breast tumors non-invasively. It may soon be used to ablate cancerous tissue in organs that are easily damaged by surgery, such as the brain and the prostate. MR cannot ablate tissue, but it clearly distinguishes normal from cancerous tissue, and it can monitor with exquisite sensitivity changes in temperature in the tissues it scans. These abilities make it a perfect partner for thermal ablation techniques, which kill tissue by burning or freezing it but cannot "see" just how much tissue has been killed. Using $3-million machines built just for this purpose, Jolenz is pioneering the use of MR imaging *during* surgery, to monitor the ablation area precisely, ensuring that all the cancer is destroyed without damaging surrounding tissue. In the brain, where the destruction of a few millimeters of healthy tissue can mean paralysis or loss of language ability, that kind of precision is priceless.

Another adaptation of MR, functional MRI (fMRI), reveals not just internal structures but also energy consumption, pinpointing areas of high or low metabolic activity. Such scans reveal, for example, the fastest growing portions of a tumor, or brain areas that are hyper- or hypoactive in patients with anxiety disorders and attentional problems. This knowledge can aid in the choice of treatment, and follow-up scans can assess the treatment's effectiveness. Brain researchers can also use fMRI to observe the working brain non-invasively in almost real time.

Minimally Invasive Surgery

They may have a reputation for being eager to wield the knife, but surgeons are well aware that a smaller incision means a speedier and less painful recovery. Most surgical incisions are as large as they are so that surgeons can get their hands into the patient and can see what they're doing. If those needs are met in other ways—if small robotic "hands" can do the cutting and repositioning and suturing, and if visualization scopes can enable them to see what they're doing, their incisions can be much smaller—just large enough to accommodate a robotic assistant's "arm."

Across the country, surgeons are pioneering minimally invasive (endoscopic or laparoscopic) procedures for operations as extensive as coronary bypass surgery. The control unit by which the surgeon directs the robosurgeon's movements can be in an adjacent room—or across the globe. The days when patients must inevitably travel to a surgeon's hospital to have the benefit of his or her expertise are coming to an end. Telesurgery will expand patients' options and enable surgeons to serve patients who cannot come to them.

Personalized drugs, simulated surgeries, and robodocs who come to you. With so many exciting avenues of inquiry and innovation (and these are only a few of them), there are clearly many ways to be part of the changing world of health care. It's almost enough to make one look forward to being a patient in the years to come. Almost.

SELECTED RESOURCES

Molecular Medicine

"The Future of Drugs" by P. Elmer-DeWitt *et al.* (*Time*, 15 Jan 2001, pp. 57-116).

"Medicine Gets Personal" by M. Wortman (*Technology Review*, Jan/Feb 2001, pp. 72-78).

Imaging Technologies

"Downloading Your Body" by W.S. Weed (*Discover*, Sept/Oct 2000).

"Bloodless Revolution: Twenty-first Century Surgery" by H.F. Hodder (*Harvard Magazine*, Nov/Dec 2000, pp. 37-47).

Minimally Invasive Surgery

"Operating on a Beating Heart" by C. Borst (*Scientific American*, Oct 2000, pp. 58-63).

"Robosurgeons" by S. Ditlea (*Technology Review*, Nov/Dec 2000, pp. 75-80).

For more on these topics, see:
www.jhu.edu/gifted/imagine/links_84.htm

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Microarrays

DAWN OF A NEW ERA

Automated DNA-sequencing machines are generating data much more rapidly than scientists can analyze it. Eager to put this ever-growing treasure trove of information to good use, scientists are creating new technologies and data analysis systems to speed their efforts along. This article, by a bioinformatician at a leading genomics research firm, describes one of the most powerful of these technologies—one that will be a mainstay in the work of tomorrow's biomedical researchers and clinicians.

by Matthew Kidd, Ph.D.

Biologists are swimming in DNA-sequence data. Every few months, the complete DNA sequence of another species is announced. Genomes are hot.

But a raw DNA sequence is just a starting point. By itself, a string of millions of As, Ts, Gs, and Cs tells us nothing. For this information to be useful, we must find the genes within it, then find out what they do, or more precisely, what the proteins they code for do. Genes provide the instructions for how to build proteins. The next step in unlocking the secrets of genomes is to identify the proteins encoded by those genomes.

Even that is just a beginning. Knowing that a gene codes for, say, a protease, doesn't tell us how that protease is involved in the life of the cell or organism. Does it play a role all the time, or is it active only during a particular phase of development? Does its production skyrocket or plunge in times of stress? Is it involved in the cell's response to an extracellular chemical messenger, like a hormone? We don't just want to know *what* a protein does; we want to know *when* it is active, how it is involved, and how it is regulated. We want a dynamic picture of its role.

Biologists have been curious about such questions for decades. But until recently, researchers have only been able to study such questions one protein at a time, or by monitoring at most a few related proteins. While a great deal has been learned in this way, this approach reveals only a glimmer of what is happening within a cell at any given moment.

In an age of genomic science, we are no longer content to monitor the expression of a handful of genes. We want to measure the expression of hundreds of genes simultaneously—to obtain a genome-wide picture of how an organism grows, responds to its environment, and reproduces. In the last five years this dream has became a reality, with a technology called a DNA microarray.

Picking Up the Pace

A DNA microarray allows us to assay the activity of hundreds, even thousands, of genes at once.

The goal is to measure the level of expression—the extent to which a gene's protein is being manufactured—for each gene. Obtaining proteins from a cell is simple enough, but sorting them in order to count them is difficult. Fortunately each protein is generated by a messenger RNA (mRNA), and mRNA molecules are much easier to sort. So we measure mRNA levels instead of proteins. Essentially, we circumvent a big mess by measuring the number of orders (mRNAs) going into the protein factory rather than the proteins themselves.

A DNA microarray, like a computer microchip, packs an enormous amount of information into a tiny space. It has hundreds of tiny spots of single-stranded DNA, each ready to bind a complementary strand of mRNA. To create a DNA microarray, we first choose a short DNA sequence from each gene we want to assay. We synthesize millions of copies of each short sequence and attach them to a glass substrate in an organized array of spots. A microarray with DNA sequences from 10,000 genes might be only a few square centimeters in size.

To use a microarray, we extract mRNA from the cells we want to study. To enable us to detect the mRNAs later on, we attach a fluorescent molecule to each mRNA, then smear the mRNA soup on the microarray and wait a few hours. Each mRNA diffuses around until it becomes attached or hybridized to a complementary short DNA sequence. Reading the result is a simple matter of illuminating the fluorescent molecules with a laser, digitizing the resulting image, and measuring the brightness of each spot to assess the amount of mRNA bound to it (Figure 1).

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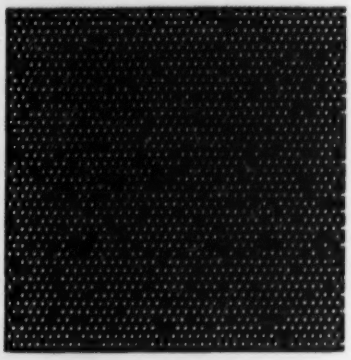

Figure 1. A DNA microarray from a single experiment. The brightness of each spot indicates the amount of bound mRNA.

Permutations and Revelations

With a microarray in hand, we are ready to ask global questions of cells. We can survey hundreds of genes at once, giving us a *DNA expression profile* for the organism or a cell in the resting state. Then we can alter the environmental conditions—by changing the temperature or the nutrients in which the cells are grown, for example—and see how the expression profile changes. We can add chemical messengers, like hormones or pheromones. Or we can remove or otherwise disable a gene. With a DNA microarray, we can watch the activities of hundreds of genes as a cell adapts to changes in its environment. We can observe the patterns of gene expression that underlie complex biological responses.

One of the most powerful features of this technology is that we don't have to know what a gene does to study it. We simply include a short sequence from it on the DNA microarray and watch what happens. We allow the gene to tell us, by its behavior, where it fits in the life of the cell. Hundreds of experimental conditions may be crossed with thousands of genes to generate an enormous matrix of expression. We can then use sophisticated computer programs to compare expression patterns and cluster genes on the basis of similarities in their behavior. Figure 2 shows an example of data from 133 genes and 112 experiments involving *Saccharomyces cerevisiae*, baker's yeast, after clustering the data. When genes of unknown function cluster with genes of known function, it is reasonable to assume that their functions are related. The functional relatedness can then be confirmed in the lab.

Expression profiling can also reveal regulatory relationships among genes, especially if we use deletion mutants—cells or organisms from which single genes have been deleted. You would expect that the removal of a gene would cause the amount of its corresponding protein to fall to zero. But the deleted gene may also regulate the behavior of other genes, by acting as an inducer or repressor. The expression of the regulated genes will be affected by the deletion, and that will show up in the expression profile for that mutant.

Time and Terabytes

The power of DNA microarrays versus older, one-gene-at-a-time assays was highlighted recently by a group of researchers at MIT's Whitehead Institute. Curious to see just how much time this new technology was saving them, they decided to use it to "rediscover" seven yeast genes it had taken them 30 scientist-years to find a few years ago. Using expression profiling, it took them just a few weeks. They not only rediscovered all seven of the known genes; they also found three new ones that were part of the same metabolic pathway.

These efforts require substantial computing resources. The finished sequence for the entire Human Genome Project will require about one gigabyte (10^9). Serious DNA microarray users have already crossed the terabyte (10^{12}) threshold, and a petabyte (10^{15}) is certain within five years. To put this in perspective, storage for the music of all active Napster users is under ten terabytes.

The size of the data set grows exponentially when we focus not on unicellular organisms, like yeast and bacteria, but on multicellular ones. They have more genes to begin with, and each cell type will have its own family of expression profiles. Muscle cells manufacture a different set of proteins than do liver cells; they develop differently, have different internal structures, perform different functions, and respond differently to metabolic stress and stimulation by extracellular messenger molecules like hormones. The nervous system and the immune system are even more complex, encompassing many subtypes of cells, each of which will have its own expression profile. Increasingly, biologists will work with bioinformaticians trained in the interpretation of expression profile data.

continued on page 17

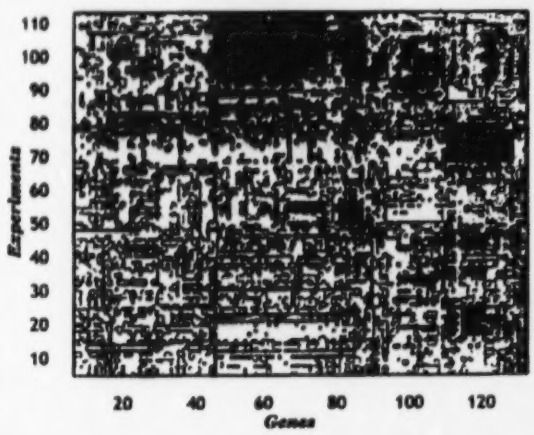

Figure 2. Gene expression data from 112 different experiments. Each row shows the data from a single microarray. Columns correspond to 133 different genes, while the rows indicate the level of expression of each of those genes in the 112 different experiments. The data have been clustered so that genes and experiments with similar profiles are near each other. This order is unrelated to their order in the yeast genome.

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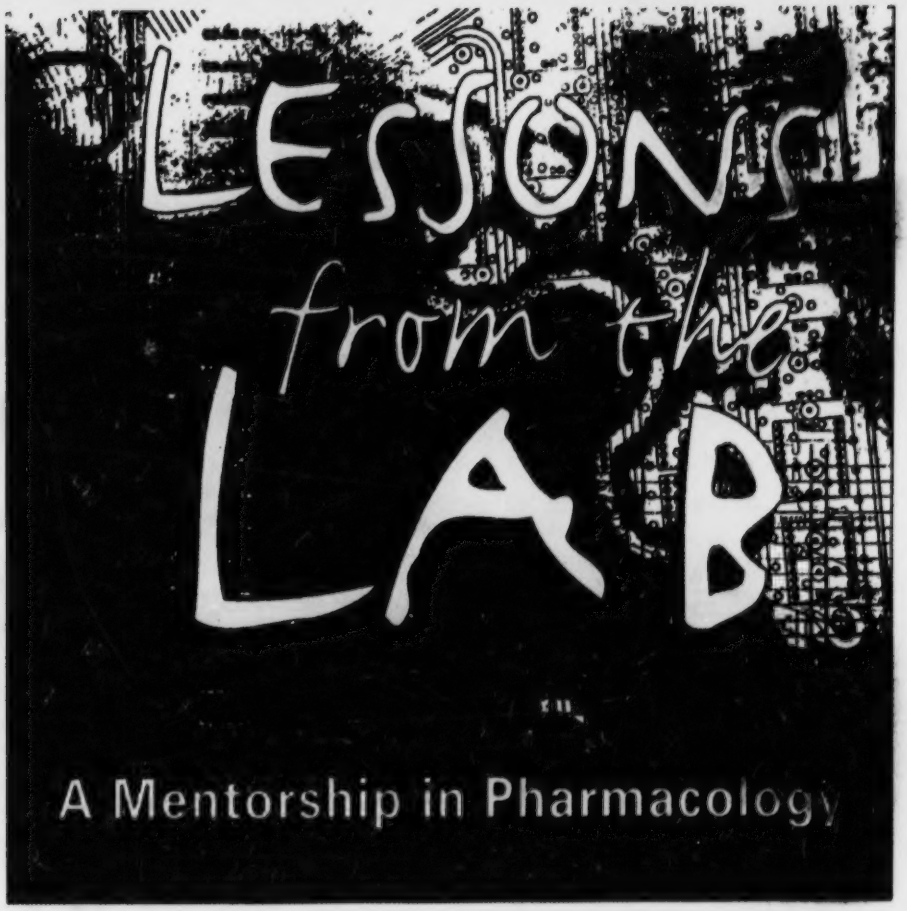

by Kevin Yang

In the pharmacology building at the University of Illinois at Chicago (UIC), I stood outside the my mentor's office for several minutes before I found the courage to knock on the door. I had applied for this opportunity through my school's mentorship office and had e-mailed and spoken on the phone with my mentor several times, but now it was real.

My apprehension faded when I was greeted by my mentor, Dr. Richard van Breemen. He put me at ease with casual conversation before explaining some of the work going on in his lab and what he had in mind for me that summer. In addition to analyzing blood samples for specific vitamins and identifying compounds, his lab is responsible for determining the binding affinities of several compounds for the National Cancer Association. I learned that the binding affinity between drugs and proteins determines the dosages that need to be administered. I was excited to learn that I would be working on this project.

Dr. van Breemen presented me with a stack of reading materials and a lab notebook and introduced to the graduate students and post-docs working in his lab. I then sat down in the lab and began reading the papers he had given me. To my relief, I found that if I concentrated and read slowly, the material was actually understandable.

Trial and Error

The following day, I tried to get started on my project, which was to determine binding affinity between a drug, Resveratrol, and a protein, human serum albumin. I was to do this using pulsed ultrafiltration, a new method developed by another laboratory at UIC. This method requires four components: a pump that provides a steady flow of buffer, an injector that allows samples to be inserted into the flow, an ultrafiltration chamber that contains a membrane, and an ultraviolet detector, which shows us how much of the drug passes through the chamber. Two trials are necessary, a control run where only the drug is injected into the chamber, and a run where the protein and the drug are injected. The pore size of the membrane in the chamber is big enough to let the drug molecules through, but small enough to trap the proteins. If the drug concentration in the second run is close to that of the control run, we know that there was little binding between drug and protein. Likewise, a big difference in concentration would reveal a greater binding affinity between drug and protein.

Before I could run any tests, my mentor told me that I had to make a buffer of ammonium acetate to fill my pump. After making a solution of the appropriate concentration and pH, I was about to fill the pump when Dejan, another guy working in the lab, asked whether I had filtered my buffer. Embarrassed, I admitted to not having done so and asked to be shown the process. I learned later that I had adjusted the pH of my solution incorrectly and contaminated my buffer before I even started by not using detergent on the glassware. Over the next couple weeks, I learned how to do everything from washing glassware properly to unplugging the capillaries of the ultraviolet detector. From the first day, I realized that I would get little done if I tried to do anything alone, so I sought help whenever I had to do something for the first time.

Near the end of my second week in the lab, I arrived one day to find that the pump I had been using wouldn't turn on. My first thought was, *I broke a $20,000 pump—I'm so dead.* Terrified, I spent much of the morning flipping the machine's switch, praying that it would magically start functioning again. Shortly before lunch, one of the post-docs came by to check on my progress and found me regarding the pump with a deep frown. When he discovered what had

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happened, he calmly explained that equipment in the laboratory often malfunctions. We then removed the cover of the pump and began poking around at its inner organs. Satisfied that nothing had exploded, we replaced the cover. Miraculously, the machine began working again.

By the end of the summer, I was finally able to acquire one satisfactory set of data. Unfortunately, after analysis, my data was too inconsistent to have statistical significance. But my project wasn't a complete failure, for through it I developed a deep understanding of the processes involved and the principles behind them.

Building a Better Chamber

I am currently building on my summer experience by continuing to work in the same lab during the school year. Now, instead of determining binding affinities between drugs and proteins, I am using my familiarity with ultrafiltration chambers to design a chamber that requires smaller samples of drug and protein, is less costly to produce, and reduces the running time. These new chambers will probably be used for screening large libraries of compounds for possible drug candidates.

I took away from my summer mentorship experience a set of laboratory skills that is proving invaluable to my coursework. In chemistry class, I am able to operate with ease equipment that others struggle with, including pH meters, pipettes, and filtering set-ups. Most importantly, I learned how crucial it is to have an understanding of the principles behind laboratory exercises instead of just going through the motions. In a real lab, it is impossible to resolve problems if you don't understand *why* you're doing what you're doing.

My summer mentorship laid the foundations for my current work on designing new ultrafiltration chambers, a unique opportunity for me to contribute to the field at such a young age. It also provided valuable exposure to actual laboratory research and to those people who have chosen this field as their life's work. With college approaching, I am certain this experience will be indispensable as I attempt to choose the path to take in life.

***Kevin Yang** is a junior at the Illinois Mathematics and Science Academy. He devotes much of his time to extracurricular activities, including math team, Science Olympiad, and a multimedia publication called Real Science. In his spare time he enjoys playing the violin, reading, and talking with his friends.*

Microarrays

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Medical Applications

Expression profiling is already transforming the pharmaceutical industry. Expression profiling of microorganisms suggests potential target genes or proteins against which novel antibiotics and antifungal agents may be developed. It will also aid in screening new drugs, showing which ones have a desired effect on target protein levels, and detecting which ones have undesirable "off target" effects. Discovering this early in the drug screening process will save time and money.

Just as expression profiling will be a powerful tool in understanding the life cycles of healthy cells, it will also help us better understand genetically altered cells—cancer cells. Cancer researchers already know that the precise mutations that cause cancer in one patient are likely to be different from those in another patient. More than 1,000 different mutations have been found in p53, one of the most commonly transformed genes in human cancers. Because of this genetic heterogeneity, a drug that is effective in treating one cancer patient might not work well on another patient with the same kind of cancer but a different set of mutations. Expression profiling of cancer cells will help us categorize the range of mutations that can cause cancers in each tissue and enable physicians to match cancer treatments to the mutations in individual patients' cancer cells.

DNA microarray prices will drop rapidly. Current prices as high as $10,000 per chip should fall below $1,000 within two years; $100 is possible in five years. At this price, smaller chips reporting on only a few hundred genes may be widely used as medical diagnostics. Doctors' offices and pharmacies may be able to run diagnostics in under an hour, using expression profiles to select drug regimens tailored precisely to the patient's biochemistry. Accurate, patient-specific drug selection and dosing should become a reality.

I would not be surprised to one day see an implantable device that reports on dozens of genes every five minutes. It may become possible to watch your body react to everything you digest. How many of us will dare to watch?

***Matthew Kidd** is a former cosmic ray physicist and TRS-80 hacker turned bioinformatician. He is currently the chief software architect for Informatics at Rosetta Inpharmatics in Kirkland, WA, just a **stone's** throw away from Microsoft. Frequently, he can be found playing bridge or Go. He is planning a one- to two-year worldwide bicycling trip after Rosetta.*

For more about microarrays, see:
www.jhu.edu/gifted/imagine/links_84.htm

You already know that veterinarians take care of cats, dogs, parakeets, and horses. Some specialize in the care of reptiles or birds; others, in treating large animals. But how much do you know about the vets who tend to animals like reindeer, bears, elephants, and bison? In the following three articles, three vets describe their work with animals most of us see only from afar.

ON THE WILD SIDE OF VETERINARY

A Vet in Training

by Cheryl Rosa, D.V.M.

I became interested in biology at a young age, mainly as a side effect of growing up on the ocean and spending a lot of time in nature. I knew that someday I would work with animals.

I attended veterinary school at Tufts University School of Veterinary Medicine, which has a strong Wildlife and Conservation Medicine program, and I had worked in a variety of wildlife-related positions. But even with that experience, I knew that the chances of finding a job as a wildlife veterinarian were slim. There were simply too few jobs and too many people looking to fill them—people with far more experience than I had.

That is why I felt especially lucky to land my current position at the University of Alaska–Fairbanks. The university has more than 500 research animals, most of which are captive wildlife, including musk oxen, caribou, reindeer, arctic ground squirrels, geese, various passerines, black bear, and arctic fox. My work here has two parts: to perform the duties of a veterinary resident in wildlife medicine, and, as a doctoral student, to study the health of what may turn out to be the world's longest-lived mammal: the bowhead whale (*Balaena mysticetus*).

As a resident, I work with our attending veterinarian to keep our research animals healthy and to assist scientists in conducting their research. On any given day, I may be called out to examine a lame musk ox or a caribou that is losing weight. Often, there is nothing "in the book" on how to diagnose or treat these problems. Fortunately, my advisor and our technicians have a lot of experience with these animals, and I can also apply some of what I know about domestic animal medicine in caring for our research animals.

Much of the research being conducted here investigates the nutritional requirements and physiologic adaptations required for these animals to survive in the harsh arctic environment. These studies look at such things as how frogs found in Fairbanks survive our minus-40° temperatures and how bears manage to slow their metabolism, minimize waste production, and survive reduced kidney function during hibernation. This information is used to aid in human research for strokes, heart disease, and survival in extreme environments.

My Ph.D. research involves conducting a health assessment of bowhead whales, an endangered arctic mysticete whose population was decimated by commercial whaling. Today, a small number of whales are hunted by natives for subsistence purposes. The Inupiat allow me to be present at their annual hunt in Barrow, Alaska, and to sample tissues from these whales, which I use to investigate histology, toxicology, blubber morphology/physiology, and wildlife disease.

After working here for four years, I will have my doctorate and will be eligible to sit for the board examination in veterinary toxicology. I hope to continue my work in marine mammal health assessment, with an emphasis on the effects of persistent organic pollutants (POPs)—chemical substances that persist in the environment, bioaccumulate through the food web, and may pose risks to human health and the environment—on both the individual organism as well as the subsistence consumer, whether human or bear.

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MEDICINE

Wildlife Veterinary Epidemiology

by Dominic Travis, D.V.M., M.S.

Epidemiology, the study of diseases in populations of humans or animals, is a specialty of both human and veterinary medical fields. Since I am a veterinarian, I am concerned primarily with diseases that affect animals, but I also do a lot of work with zoonotic diseases, which affect both humans and animals.

As the veterinary epidemiologist at the Lincoln Park Zoo in Chicago, my job is to look at the health of entire populations of species held in captivity in North American zoos. For example, I am currently studying the effect of tuberculosis, a deadly bacterial disease affecting all mammals, on zoo animals and zoo personnel. I am looking at hoofstock (antelope, zebra, giraffes), as well as larger animals like rhinos and elephants, in order to determine how bad a problem this disease is in North American zoos. This is a particularly hot issue because it is suspected that the disease is being transmitted between animals and zookeepers, therefore making it a public health issue as well. As you can see, my job is to look at the big picture rather than the individual animal.

Veterinary epidemiologists are involved with wildlife field projects as well. I am currently working on a project with wildlife veterinarians in charge of monitoring the health of the few remaining mountain gorillas in central and eastern Africa. We are working to set up a protocol for investigating outbreaks of zoonotic diseases, such as tuberculosis and measles, should they be transmitted to gorillas as a result of increased contact with man due to eco-tourism and a general increase in the human population in that area.

When I first entered the field of veterinary medicine, I wanted to be a traditional zoo and wildlife veterinarian. But the more I thought about it, the more I wanted to have an impact on wildlife conservation on a broader level. My current job gives me the best of both worlds. I get to work with small, endangered populations of animals in the zoo community, and I get to be involved in wildlife conservation through conducting field studies. I never knew life as a vet could be so good.

Wildlife Disease Research

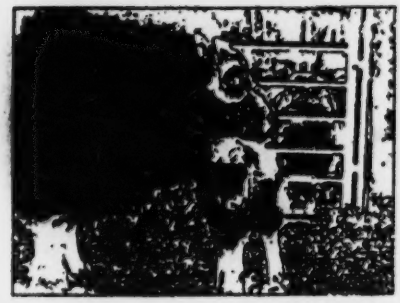
by Steve Sweeney, D.V.M., M.S.

Whack! Bison #863 flinched as the dart hit her shoulder. But instead of moving away from me with the rest of her group, she circled past me and trotted downstream, followed by her calf. I cursed at my failure to anticipate her

escape route, and prayed the drugs wouldn't take effect while she was crossing the Madison River. Burdened by our heavy packs and snowshoes, our crew was no match for the pair's quickening pace, and we soon lost sight of our quarry. Finally, after a 20-minute hike and wading chest deep in the river, we reached the bison on an island where she had fallen just short of a second river crossing. We checked her vital signs, set to work collecting samples and assessing her pregnancy status, and injected the antagonist drugs that would revive her. Seven minutes later, #863 was back on her feet, heading toward her calf.

As a veterinary medical officer with the U.S. Geological Survey in Bozeman, Montana, I conduct research on wildlife diseases. The focus of my research is brucellosis, a nonfatal illness that affects bison and elk inhabiting federal land in and around Yellowstone National Park. Brucellosis causes miscarriages in cattle and wildlife, and occasionally infects people with undulant fever. Ironically, brucellosis did not originate in bison or elk, but probably was transmitted from cattle imported to the U.S. in the early 1900s. Now that this disease has been eliminated from cattle in most states, its presence in Yellowstone's wildlife is a potential risk to the livestock industry.

Although I've always had a keen interest in animals, becoming a wildlife veterinarian was not a long-range goal. Growing up in the city, I collected an assortment of reptiles, amphibians, and carnivorous plants. I loved drawing and reading about wildlife, and started birdwatching after my grandparents gave me a field guide for my ninth birthday. But my most prized possession was a butterfly net that I wielded with authority. I vividly remember an outing at Seattle's Woodland Park Zoo, where I discovered the net was quite useful for catching pigeons! In college I majored in zoology, then pursued a master's degree in wildlife biology. Subsequently, I worked as a wildlife biologist, studying a variety of creatures, from lynx inhabiting Washington's montane forests to bald eagles nesting along the shorelines of Puget Sound.



As I advanced in my profession, I found myself spending too much time in the office and too little time outdoors doing the kind of work that I really enjoyed. After weighing the benefits and costs of a career change, I decided to pursue a veterinary medical education with the goal of becoming a wildlife veterinarian. By building on my background in animal ecology, I felt I could make a valuable contribution to the field of wildlife conservation.

My careers as a wildlife biologist and as a veterinarian have taught me the importance of balancing humanity's needs with responsible stewardship of our natural resources. Where social and political obstacles can be overcome, modern veterinary medicine offers valuable tools for managing and protecting our planet's wildlife.

***Cheryl Rosa** earned a B.S. in animal science and zoology from the University of Massachusetts and her D.V.M. from Tufts University. She expects to earn her Ph.D. in marine biology from the University of Alaska in 2004. Cheryl spends her free time hiking, camping, kayaking, and, the Alaskan winter favorite, quilting.*

***Dominic Travis** earned a B.S. in zoology from North Carolina State University, a D.V.M. from Michigan State, and an M.S. in epidemiology from the University of Maryland. Dominic enjoys soccer, hockey, hiking, and camping, as well as traveling, photography, and reading about history.*

***Steve Sweeney** earned a B.S. in zoology and an M.S. in wildlife & forest resources at the University of Washington. After working as a wildlife biologist for 15 years, he returned to school, earning his D.V.M. from Washington State University. Steve lives in Bozeman, MT, where he enjoys wildlife photography, golf, hiking, and skiing with his wife and two daughters.*

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A Doctor Without Borders

continued from page 5

But that's not what the majority of people suffer from. Most people suffer from more chronic things, like headaches and joint pain. In some cases, Western methods can be very effective, but other times, herbal medicines or acupuncture or massage therapy can be just as effective. I think there's a lot to be gained from combining these methods. Even when we prescribed Western medicines, I encouraged patients to continue taking their Tibetan herbal medicines, to use both at the same time.

Did you learn anything from the Tibetan doctors?

I got a sense of how they approach patients, what they look for, and how they make physical diagnoses. But their teaching is based on a long-term apprenticeship, and they weren't comfortable saying, "for this problem we use this herb." The Western approach is to figure out what the problem is and what medicine treats it. Their approach involves assessing imbalances in different forces, different strengths and weaknesses, and using a combination of herbs to augment things. That doesn't translate very easily into the Western approach, but it showed me different ways to look at disease and patients, and it broadened my ways of thinking about health.

At the end of your mission, what were you most proud of?

I felt proud of the work I was able to do on individual cases—the elderly people I was able to help walk, the girl with the fractured skull. Those things are rewarding; working with patients always is. And there was one local doctor in particular who really caught on to what we taught her about physical diagnosis and how to use medicines.

It was also rewarding to develop a relationship with this culture and the people of the town. The friendships, the understanding, the sharing between people from different places, all of that is very gratifying.

How did your experience in Tibet change you?

It's funny, when I listen to myself describing my experience to friends, it sounds like it should have been a transforming experience, but it wasn't really that much of a departure for me. It was exciting to be there, but I was working with people and patients and teaching and working to understand another culture like I do at home, so it didn't really feel so different.

I think what had the biggest effect on me was seeing how the villagers' beliefs are integrated so profoundly into their daily life. I was moved by how elemental their belief and religion is, and how natural it all is. That was what impressed me most: the awareness of the world around them—of the presence and majesty of barren mountains and harsh rivers—and the incorporation of that respect for nature in the way they live.

Do you plan to go on another mission?

I do, and I don't know where. I've thought about doing some work in Africa. Since I've done a lot of work with refugees here, I'm really interested in doing work in a refugee camp. But it depends on where I am needed. If I could help with something like the earthquake in India, I would want to do that.

I'm going to wait another month or two. I definitely didn't want to go right back out after I came back; I needed time to distill the experience and get back in touch with things here. But soon I will go where I am most needed. And I will keep going. I think that will be a pattern for me.

MÉDECINS SANS FRONTIÈRES

Known as Doctors Without Borders in the U.S., Médecins Sans Frontières (MSF) was established in 1971 by a group of French doctors to offer emergency medical assistance to victims of war and natural disasters. Now with offices in 18 countries, MSF sends more than 2,000 volunteers to more than 80 countries every year, where they offer medical assistance to victims of war, epidemic, and natural and man-made disasters. MSF won the Nobel Peace Prize in 1999.

MSF recruits not only physicians and surgeons but also nurses, nurse practitioners, physician assistants, nutritionists, epidemiologists, and midwives to carry out its programs. Volunteers usually commit to at least six months and more typically to a year of work in the field.

For more information about MSF/Doctors Without Borders: *6 E. 39th St., 8th floor, New York, NY 10016; (212) 679-6800; doctors@newyork.msf.org; www.doctorswithoutborders.org*

SELECTED RESOURCES IN MEDICINE AND HEALTH SCIENCES

SUMMER PROGRAMS

Adventures in Veterinary Medicine
Tufts University School of Veterinary Medicine, Adventures in Veterinary Medicine, 200 Westboro Road, North Grafton, MA 01536; (508) 839-7962; www.tufts.edu/vet/avm/

This program, offered by one of the best vet schools in the country, features a one-week commuter session for middle school students and a two-week residential session for high school students. Participants attend lectures by Tufts faculty and residents on topics including animal behavior, equine sports medicine, wildlife medicine, biotechnology and veterinary medicine, and several others. Students also shadow fourth-year vet residents on clinical and surgical rotations, attend talks by guest speakers, and take related fieldtrips. **Application deadline: February 1.**

Center for Talented Youth Summer Programs
CTY Summer Programs, Johns Hopkins University, 3400 N. Charles Street, Baltimore, MD 21218; (410) 516-0277 or -0278; ctyinfo@jhu.edu; www.jhu.edu/gifted/

Students in grades 7 and up who earn qualifying scores on the SAT-I may take three-week courses in a variety of disciplines. Several courses related to health sciences and medicine are offered, including Animal Science, Exercise Physiology & Sports Medicine, Biotechnology, Medical Sciences: Pharmacology & Toxicology, and Introduction to Neuroscience. **Application deadline: March 31.**

National Institutes of Health Summer Internship Program in Biomedical Research
www.training.nih.gov/student/internship/internship.asp

Students who are at least 16 years old may apply for internships at 22 institutes and centers within NIH, ranging from the National Cancer Institute to the Center for Information Technology. Internship lengths and dates vary by center, but all require a minimum commitment of eight weeks. **Application deadline: March 1.**

National Student Leadership Conference
Office Of Admissions, NSLC, P.O. Box 811086, Boca Raton, FL 33481; (800) 994-6732; www.nslcinfo.org/med.html

High school students are selected to attend NSLC based on a nomination from their school or from NSLC alumni, or students may submit a merit application. In the five-day Medicine & Healthcare program (four sessions offered at George Mason University in VA), students meet researchers and doctors; observe a surgery; tour institutions such as the National Institutes of Health, the Johns Hopkins Medical Campus, the American Red Cross, and the World Health Organization; and participate in discussions about a range of current health care issues. **Application deadline: Rolling admissions.**

Science Scholar Research Institute
Dr. Charles R. Granger, College of Arts & Sciences, 239 Research Complex, University of Missouri-St. Louis, 8001 Natural Bridge Road, St. Louis, MO 63121-4499; (314) 516-6226; www.umsl.edu/~sep/ssri.htm

Rising high school juniors and seniors as well as recent graduates may attend this six-week program. Students choose a topic of interest and are then matched with a research mentor from a university, medical school, or optometry school. College credit available. **Application deadline: March 31.**

Summer Medical Enrichment Program
Texas A&M Health Science Center, Office of Special Programs, 104 Joe H. Reynolds Medical Building, College Station, TX 77843-1114; (979) 862-4065; http://medicine.tamu.edu/sprogram/enrichment.htm

In five-day sessions, rising juniors and seniors tour clinical facilities; meet science and clinical faculty, physicians from several specialties, and medical students; and attend panel discussions with Texas A&M University faculty, undergraduate students, and medical students. **Application deadline: Rolling admissions until April 27.**

Summer Scholars Premedical Studies
Summer Scholars, Washington and Lee University, Lexington, VA 24450-0303; (540) 463-8722; http://summerscholars.wlu.edu/academics/Premed.html

Rising seniors may apply for this four-week program, during which they take three courses: Biology, Chemistry, and Chaos in Biological Systems. Students also attend lectures by health-care professionals and visit nearby schools of medicine. **Application deadline: Rolling admissions until April 30.**

ACADEMIC COMPETITIONS

Harvard Biological Sciences Olympiad
Ravi Shah, HBSO Director, (617) 493-3320; rshah@fas.harvard.edu; www.hcs.harvard.edu/~hsr/hbso/elig.html

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A contest similar in format to the USACO, the USNCO, and the USAMO, the HBSO consists of a two-round, exam-format contest. Sponsoring teachers register students in grades 9-12 to take a 90-minute selection examination; two students from each school will be selected to take the national exam.

Intel International Science and Engineering Fair
Science Service, Intel ISEF, 1719 N Street, NW, Washington, DC 20036; (202) 785-2255; www.sciserv.org/isef/

Two individuals and one team from each of 500 Intel ISEF-Affiliated Science Fairs advance to the ISEF. These high school students compete for scholarships in 15 categories (including Medicine & Health). The top three winners overall receive $40,000 scholarships. First, second, third, and fourth place winners in each category receive $3,000, $1,500, $1,000, and $500, respectively, in each of the 15 categories; additional awards include tuition scholarships, summer internships, scientific field trips, and laboratory equipment. The two overall winners win all-expense-paid trips to attend the Nobel Prize Ceremony in Stockholm, Sweden. **Deadline: Check with your local ISEF affiliate, available on the Web site, for dates of local fairs.**

Intel Science Talent Search
Science Service, Intel STS, 1719 N Street NW, Washington, DC 20036; (202) 785-2255; www.sciserv.org/sts/

After completing independent research projects, high school seniors submit a written description of their research and a 12-page entry form. From the 300 semifinalists, 40 finalists are selected to travel to Washington, D.C., for final judging. Ten finalists receive one of the following four-year scholarships: one $100,000, one $75,000, one $50,000, three $25,000, or four $20,000. The remaining 30 finalists each receive a $5,000 scholarship. **Deadline: Entries are due in late November.**

PROFESSIONAL ORGANIZATIONS TO CONTACT FOR MORE INFORMATION

The Web sites of the following organizations include valuable information about education and careers; most also contain links to specialty organizations within the field.

American Academy of Nurse Practitioners
P.O. Box 12846
Austin, TX 78711
(512) 442-4262
www.aanp.org

American Academy of Physician Assistants
950 North Washington Street
Alexandria, VA 22314
(703) 836-2272
www.aapa.org

American Dental Association
211 E. Chicago Avenue
Chicago, IL 60611
(312) 440-2500
www.ada.org

American Medical Association
AMA Chicago Headquarters
515 N. State Street
Chicago, IL 60610
(312) 464-5000
www.ama-assn.org

American Medical Informatics Association
4915 St. Elmo Avenue, Suite 401
Bethesda, MD 20814
(301) 657-1291
www.amia.org

American Nurses Association
600 Maryland Avenue SW
Suite 100 West
Washington, DC 20024
(202) 651-7000
www.nursingworld.org

American Public Health Association
800 I Street N.W.
Washington, DC 20001
(202) 777-APHA
www.apha.org

American Veterinary Medical Association
1931 North Meacham Road, Suite 100
Schaumburg, IL 60173
(847) 925-8070
www.avma.org

National Health Council
1730 M Street, NW, Suite 500
Washington, DC 20036
(202) 785-3910
www.nhcouncil.org

WEB SITES

Career Advisor: Health and Medicine
www.careeradvisor.com

Once you enter the Health and Medicine category, click on a career to learn about the job outlook, salaries, links to organizations in the field, and more.

Considering a Career in Medicine
www.aamc.org/students/considering/start.htm

A good place to start if you're just beginning to consider a career in medicine, this site includes answers to basic questions about the medical profession and medical school.

Review.com: Medical School
www.review.com/medical/

Visit this site by Princeton Review for information about medical schools, but especially for the insights offered into life as a medical student.

BOOKS

270 Ways to Put Your Talent to Work in the Health Field by the National Health Council (1998). To order, write to National Health Council, 1730 M Street NW, Suite 500, Washington, DC 20036, or call (202) 785-3910.

Animal ER: Extraordinary Stories of Hope and Healing from One of the World's Leading Veterinary Hospitals by Vicki Croke, Tufts University School of Veterinary Medicine (E. P. Dutton, 1999).

Becoming a Physician: A Practical and Creative Guide to Planning a Career in Medicine by Jennifer Danek and Marita Danek (John Wiley and Sons, 1997).

How We Die by Sherwin B. Nuland (Vintage Books, 1998).

Letters to a Young Doctor by Richard Selzer (Harvest Books, 1996).

Life After Medical School: Thirty-two Doctors Describe How They Shaped Their Careers by Leonard Laster (W.W. Norton, 1998).

The Measure of Our Days by Jerome Groopman (Penguin USA, 1998).

One Hundred Days: My Unexpected Journey from Doctor to Patient by David Biro (Pantheon Books, 2000).

BEST COPY AVAILABLE

Portraying the Drama in Reality:

Interview with Documentary Filmmaker KEN BURNS

Ken Burns has been making documentary films for more than 20 years. Since the Academy Award-nominated ***Brooklyn Bridge*** *in 1981, he has gone on to produce critically acclaimed documentaries, including* ***The Civil War*** *(1990) and* ***Baseball*** *(1994). In addition, Ken Burns has produced and directed the highly recognized American Biography series. One of these,* ***Not For Ourselves Alone: The Story of Elizabeth Cady Stanton and Susan B. Anthony****, won a Peabody Award in 1999. His latest 10-part epic series,* ***Jazz****, premiered on PBS in early January.*

Born in Brooklyn in 1953, Ken Burns graduated in 1975 from Hampshire College in Massachusetts with a degree in filmmaking. He lives in Walpole, New Hampshire, where his company, Florentine Films, operates in a renovated 19th-century farmstead.

Jonas Budris, an 11th grader at the Martha's Vineyard Regional High School, interviewed Ken Burns when the filmmaker was in Boston on a promotional tour.

by Jonas Budris

You've described *The Civil War* and *Baseball* as prisms through which the story of race in America is told. *Jazz*, too, is as much a story about race as it is about music. In that, it seems a natural sequel.
Yes, very much so. I wish I could tell you that this was all preconceived, that it's some grand design of mine, but it's really not. I started *The Civil War* in 1984, knowing that I would do something about baseball afterward. During *Baseball*, I interviewed a very fine writer from St. Louis, Gerald Early. One of his memorable observations was that America has produced three defining and unique phenomena: The Constitution, baseball, and jazz music. When you are a filmmaker, a bell goes off when you hear a line like that. That was part of the planted seed of what has turned out to be a trilogy of sorts.

But that seed stayed dormant for a time?
The idea always seemed to echo. A couple of years before, I'd given a speech at the Metropolitan Museum of Art for the American Academy of Achievement. That night, I met Wynton Marsalis, and he told me I should do something on jazz. At first I dismissed it, the way you would if you were a novelist and someone told you what your next novel should be. But then as I made *Baseball*, I realized how much jazz I was using for the music track.

One day in the editing room during *Baseball*, I was putting together a scene of the 1932 World Series, the one in which Babe Ruth has the famous called shot. We used this great jazz tune called "Tickle Toe" by Count Basie and Lester Young, and I knew what my next film was going to be. And the star of that film was going to be the music.

It took you six years to make this film with thousands of hours of interviews and film clips to review. Do any moments stay with you, haunt you?
I've seen the death of Louis Armstrong 100 times, and everyone still passes the Kleenex around in the editing room when it comes up. But the scene that haunts me is when Dave Brubeck describes his real-life experience of seeing the scarred flesh of a Black man and how his father tells him, "this must never happen again." That always gets me.

Louis Armstrong plays a paramount role in the film. He seems to make an apppearance in almost every episode.
And he should have that kind of presence. Louis Armstrong changed American music, not just jazz, but all music. He created the solo performance in jazz, boiled it down, and presented the model on which later improvisation was based and continued to evolve. Rock, soul, rap—all are the progeny of jazz and hence influenced most by Louis Armstrong.

From the cultural point of view, like Duke Ellington, Louis Armstrong always celebrated his color, elevated it. It would be no exaggeration to say Armstrong was among the most influential Americans of any endeavor, not just as a musician, but as a statesman, a true ambassador.

Stephen Ambrose has said that "more Americans get their history from Ken Burns than from any other source." Is it fair to say that you have become as much an educator as a filmmaker?
It's fair and a very good thing. Bill Moyers likes to say that with PBS he has the biggest classroom in America. I feel the same thing. When we were making *The Civil War*, not a college student in America knew who I was. But four years later, college students knew who I was because they'd been watching *The Civil War* in high school classes. I would go to colleges to talk and they'd have their dog-eared Civil War books and want an autograph. And they'd want to talk about their

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great-great-great-grandfather who was in the war. That's terrifically exciting and clearly about education.

But I'm not a historian. I'm a filmmaker. I use history the way a painter chooses to work in oils as opposed to watercolors. That's what I do for a living, and I practice every day. At the same time, I get enthusiastic about the subject and need to communicate that. Tolstoy said art is a transfer of emotion from one person to another, and that's what I do.

When you were a high school student, did you know you wanted to be a filmmaker?
I wanted to be a feature filmmaker. I wanted to be John Ford and make epic, grand films in the tradition of the great westerns. I went to college with that intention, and I met all these

social documentary still photographers who also made documentary films. That department at Hampshire College was the only place I've ever found where photography and film were in the same location. There I had my head totally turned around.

I realized that reality is far more dramatic than anything we can make up. Shelby Foote told me that "God is the greatest dramatist," and one need only look at the irony of Ford's Theater, five days after Lincoln won the war, to see it's true. Or the notion that America's classical music, America's Bach or Beethoven, would come from some Louis Armstrong, a kid whose mother was a some-time prostitute, a kid born into abject poverty on the streets. That's a great story. If you made it up no one would believe it.

Inexpensive digital technology in some ways has the power to revolutionize documentary filmmaking. Most high schools have the equipment capable of making a fine quality film. Do kids today have an advantage you never had?
Yes and no. The old linear forms are so expensive and so difficult to master that you didn't dare do something until you were absolutely sure of what you wanted to do. With film, you have this terror of the moment, but it forces a kind of attention. The film costs $125 a roll, which only gives you seven minutes. Add another $125 to process, and yet another $225 to make a working print. Then factor in paying the camera man and the sound man and how long it's going to take you to edit. When you pull that trigger, you better be darn sure it's good. You better be darn sure you know what you are filming.

With video, you can always erase it. There's less force to that moment. So it's liberating in one way, but it's imprisoning in another. On the plus side, there's a huge democracy to the digital revolution.

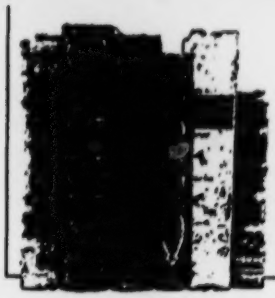
In *Baseball* when Boston Red Sox slugger Ted Williams was asked what he wanted to be remembered for, he answered, "when someone sees me on the street I want them to say, 'there goes the best hitter in baseball.'" Do you want to be seen in the same way as the best documentary film maker in the business?
Yes, insofar as I want each frame, each sound, each chord in the film to reflect the best of who I was at the moment I let that film go. I can look back and see mistakes now in other films, or things I would do differently, but I never want to change them, because they are accurate snapshots of who I was.

And I never want to be in a position where I have to apologize for some outside influence on myself, which is why I stay with PBS. I don't ever want to have to say, they made me do it shorter or longer, or they took it away from me, they recut it. If my film is bad, I want it to be my fault.

Do you have any advice for high school students who are drawn to filmmaking?
The main thing is to do what Emerson said: "Do what inly rejoices." But also realize that it will always be an uphill struggle, that no one will hand it to you, particularly not in documentary. Making *Jazz* is the hardest thing I've ever done, and it makes me a better person as well as filmmaker to have attempted that.

It's all about the force of will and concentration. At the end of the day the only thing we have is our attention. And the things that we value most—that you value most, that I value most—come from the benefit of our full attention. Meaning accrues in duration; it is a byproduct of our attention. If you develop your attention, that's all you can do. All you can do in the world.

***Jonas Budris** describes himself as an M&M student—math and music. He attended CTY summer programs for four summers and continues with EPGY distance learning. Jonas is a fan of jazz and was selected to perform with the 2001 All Eastern United States High School Music Festival in Pittsburgh in March.*



Off The Shelf

The Count of Monte Cristo by Alexandre Dumas

by Shengping Yu

The banker leaned back in his chair with a heavy, arrogant smile and said, "Oh, don't be afraid to ask; you may be sure that my funds, limited, though they may be, are sufficient to meet the highest demands, and even if you were to ask for a million—"

"Pardon?"

"I said a million," repeated Danglars, with all the self-assurance of stupidity.

"But what good would a million do me?" said the count. "If I needed only a million I wouldn't have bothered opening a credit for such a trifling sum! Why, I always carry at least that much with me." So saying, he drew from his card-case two treasury bonds for five hundred thousand francs each.

A man like Danglars must be bludgeoned, not merely pricked, and this blow had its effect. He stared at Monte Cristo in a daze.

Readers of Alexandre Dumas will remember this captivating scene from *The Count of Monte Cristo*, when the count, his outward calm belying his inner fury, faces 20 years later the conspirators who caused his suffering. The previously peaceful Parisian society would never be the same again as its three most powerful figures are struck down, one by one, through the count's carefully wrought bankruptcies, family ruptures, and scandals.

The year is 1815. An exuberant young sailor named Edmond Dantès returns from a successful business trip, during which he speaks with Emperor Napoleon. As Dantès dreams of a bright future as the captain of *Pharaon*, three men plot against him: one out of jealousy, one for position, and one to steal Dantès's fiancée. After Napoleon's exile, they frame the innocent man as a sympathizer of the Emperor, resulting in Dantès's arrest on his wedding day and life imprisonment in the dungeon Chateau d'If.

After Dantès learns from a fellow inmate, Faria, that he had been imprisoned through collusion and deceit, an ominous, irreversible change takes place in Dantès, and Faria sighs, "I regret...having told you what I did." Also while imprisoned, Dantès learns of a secret treasure on the island of Monte Cristo, and devises a daring plan to escape, find the treasure, and eventually wreak vengeance. When Dantès finally enters the frivolous Parisian society to seek his revenge as the Count of Monte Cristo, he plays his enemies against their own decadent histories—what brought them to power brings them to their downfall.

In one of the most widely read adventure stories of all time, Alexandre Dumas, also the author of *The Three Musketeers* and *The Man Behind the Iron Mask*, focuses the fast-paced plot of *The Count of Monte Cristo* on two central themes: the transformation of a guileless sailor into the cold, calculating count, and the execution of the count's brilliant revenge.

The thrilling effect of the count's adventures does, however, require some tolerant credulity on the part of the reader. Dumas often makes inaccurate historical references, and the plot relies on a series of unlikely coincidences. For example, after associating with former friends and enemies in the guise of many different identities, the count parades around Paris completely unrecognized by any of them. And the count's emotions reveal implausible inconsistencies: he is relentlessly cruel toward his enemies and emotionless toward those loyal to him; yet when he hears the tale of his anonymous good deed, he pales uncontrollably.

In the end, though, Dumas makes up for the occasional foibles with the intense excitement that accompanies the count's every move, from "bludgeoning" Danglars at the bank to throwing a soirée at a house where the public prosecutor is haunted by his former involvement in a crime. Dumas's fascinating portrayal of the Count of Monte Cristo as an omniscient, omnipotent, and omnipresent being is what draws so much admiration from the reader: It reminds us all of what we, too, would like to be. Readers also relate to the count as they share the regret for Dantès's lost opportunities and youth. When he addresses his former fiancée as "Madame," weeps by his father's grave, and shakes with emotion at the mention of his late employer, it is readily apparent that the count would have willingly given up all his dazzling wealth just to become Dantès again. And despite all his implacable wrath, he ultimately realizes that revenge can only cause more pain, and prays, "God grant that I haven't done too much already!"

The count's spellbinding magic lingers long after he disappears behind the "dark blue line separating the sky from the Mediterranean," as the story of *The Count of Monte Cristo* ends like it began—not with a bang, but with a tear.

***Shengping "Shelby" Yu** is a 15-year-old junior at River Hill High School in Columbia, MD, where she edits the literary magazine, competes on the math team, and is active in student government and the Students Helping Other People club. Shelby is a member of **Imagine**'s Readers Panel.*

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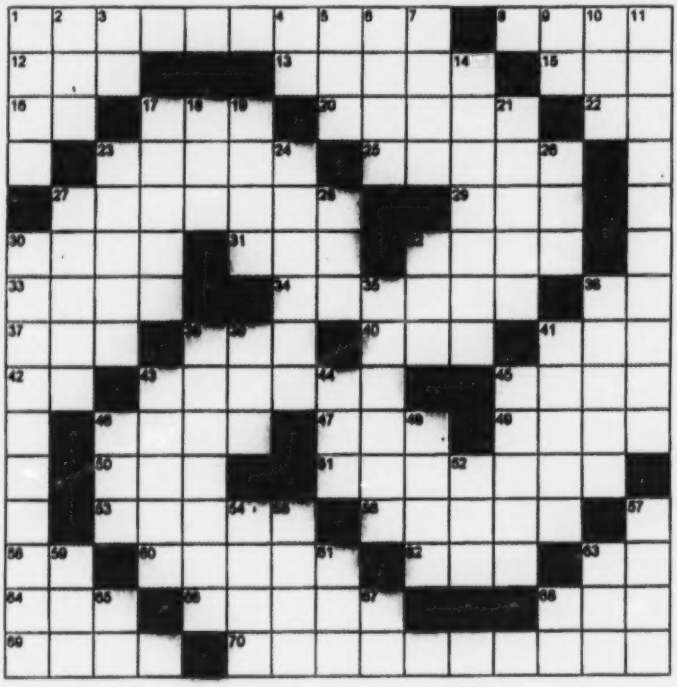
Word Wise: Medical Jargon

by Carol Blackburn



ACROSS

1 Irregular heart beat
8 Skin eruption
12 Cyclooxygenase (abbr.)
15 Catch in the throat
15 Inflamed sebaceous gland at the margin of an eyelid
16 Disease on the increase due to antibiotic resistant strains (abbr.)
17 Facial spasm
20 Laceration
22 Loudness unit (abbr.)
23 Hemp-like fiber
25 Heavily loaded
27 In the wrong place (med.)
29 Flightless bird
30 Father
31 A pituitary hormone (abbr.)
32 Give off
33 Bacterial growth medium
34 __ elbow
36 Brown locale
37 Author Stanislaw ___
38 Life (Fr.)
40 Organization for Economic Cooperation (abbr.)
41 Frequency unit (abbr.)
42 Sir
43 Prohibited
45 Canal
46 Endocrine glands lack this
47 Make an incision
49 Lairs
50 Curve
51 From the Latin for "I shall please"
53 Leg extender
56 Tests
58 Element used to treat manic-depressive illness (abbr.)
60 Sleep noisily
62 Retirement account (abbr.)
65 Kind of heart attack (abbr.)
64 Liquid crystal display
66 Gut bacteria (2 wds.)
68 An oncogene
69 Seizure warning sign
70 Of unknown cause or origin (med.)

DOWN

1 Pituitary "master hormone"
2 Knock off
3 Prescription
4 Hectoliter (abbr.)
5 Trim
6 Graven image
7 Water (Sp.)
9 Like
10 Chlamydia is one (abbr.)
11 Binds to a complementary strand of DNA
14 Occurring continuously in a population
17 Antibody concentration in a solution
18 Personals abbr.
19 Military leader (abbr.)
21 Ms. Moore's
25 Exit quickly
24 Pioneer of antiseptic medicine
26 Crank
27 *The __ Sanction*
28 __ Guevarra
30 Major cause of food poisoning in the U.S.
32 Suffix indicating a double bond
35 Small, abnormal knobby lump
36 Nose (med.)
38 Immune system stimulant
39 NYC subway line
41 Citric acid cycle
43 Lancaster and Reynolds
44 Enhanced capabilities port (abbr.)
45 Swelling
48 The (Ger.)
48 Cab
52 Vehicle
54 Locations
55 Walked
57 Cartilaginous vertebral cushion
59 Hospital area for critically ill patients (abbr.)
61 __ Lilly pharmaceutical firm
63 May, in Marseilles
65 MD
67 One of Jupiter's moons
68 Blood factor

Solution on page 30

Law Professor

Interview with Pam Karlan

by Carol Blackburn

An expert on election law, Stanford Law School professor Pam Karlan found herself in demand during November and December, as the nation raced to follow the legal intricacies of the Florida election contest. You may have seen one of her many appearances on *The News Hour with Jim Lehrer* or *Nightline*.

Professor Karlan has been active in pro bono litigation on behalf of civil rights and civil liberties groups. In 1997, she was honored by *The American Lawyer* as one of 45 "young lawyers outside the private sector whose vision and commitment are changing lives."

When did you first become interested in a career in law?

I read a book called *Simple Justice* by Richard Kluger when I was in high school. It was the story of the litigation that led up to *Brown v. Board of Education*, the Supreme Court decision holding that racial segregation in public schools violates the Constitution. I was just captivated, and I decided that when I grew up, I wanted to become a lawyer for the NAACP Legal Defense Fund (LDF), an organization founded by Thurgood Marshall, the lawyer who argued the Brown case. As your readers probably know, Marshall went on to become the first African-American member of the U.S. Supreme Court.

So you didn't aspire to be a law professor when you went to law school?

No, I was still planning to work for the LDF. I interned at the LDF during my summers in law school and confirmed that that was where I really wanted to work. I really loved law school, and a lot of my professors said that I ought to think about teaching law. It was always in the back of my mind that I might go into teaching; many people from the LDF have. But when I was offered a permanent job at the LDF, I said to myself, "This is why I went to law school!"

You were offered your dream job straight out of law school?

Not exactly. I first clerked for two years. A law clerk is a kind of confidential assistant to a judge. Clerking is the best job in the world for young lawyers, and top law students are encouraged to clerk no matter what they plan to do with their careers.

Tell us a little about that experience.

I had two very different sorts of clerkships. The first one was with a federal trial court judge in New York City. At a trial court, you prepare for trials. That year, much of our work concerned a big Mafia trial. It was an interesting case—kind of like *The Godfather* come to life. Ultimately, after I finished my clerkship, the lead defendant in the case was gunned down on the street in New York City. Overall, the district court clerkship was really fast paced, with lots of interaction with lawyers. I also spent a fair amount of time in the courtroom while the judge heard motions and presided over trials.

The next year, I clerked at the U.S. Supreme Court for Justice Harry Blackmun, and that was a very different kind of job. It was almost entirely library work. The amount of time the Supreme Court spends actively hearing cases is only about 150 hours per year. The rest of our time was spent in the library, reading the briefs, reading the records, writing memos to the justice, talking about the cases with the justice and our co-clerks, making recommendations, and writing drafts of opinions.

As clerks, we watched as oral arguments were made to the Supreme Court, but we didn't accompany the justices when they retired to discuss cases. However, after every conference, Justice Blackmun would come back and read us his notes, and we would help draft his opinions. It was an invaluable look at what goes on inside the Supreme Court, and an experience that has served me well when I've argued cases there, which I've done twice now.

How did your experience as a clerk help you when you presented cases there?
In both cases, I was actually more comfortable presenting my case to the Supreme Court than I had been in the lower courts. That sounds kind of strange, since the stakes are much higher in a higher court. But for me, it was like going home, especially in the first case I argued there, which occurred when Justice Blackmun was still on the bench and I knew most of the other justices. That familiarity wasn't going to affect the judges' evaluation of the merits of the case—I was pretty sure that no matter how many friendly meals I'd had with Chief Justice Rehnquist, I wasn't going to get his vote—but it made it a much more comfortable experience for me.

Let's return to when you went to work at the LDF.
When I started there, I thought I would be working on school desegregation cases, but another young attorney had started there just before I did and she wanted to do school desegregation. So they gave her schools cases and they gave me voting rights cases. It was one of the most fortunate accidents in a relatively fortunate life, because I have loved working on voting rights cases.

Had you specialized in a relevant area of law while you were in law school?
There aren't majors in law school; no one is a "civil rights law" major. I took a lot of courses that turned out to be helpful to me in many ways. But the most helpful thing was just getting a well-rounded legal education and learning to read legal cases and make legal arguments. And that's a transferrable skill from one area of the law to another. It turned out, for example, that the first brief I worked on for the LDF was on a question of civil procedure, and the most relevant course I'd taken in law school was actually one on antitrust law, where there is a similar procedural problem.

What made you decide to leave the LDF after only two years and become a law professor?
I found that I really didn't like dealing with opposing counsel in some of my cases. Litigation is inherently confrontational, but sometimes opposing counsel were so resistant and obnoxious that it made the day-to-day work too stressful.

The thing I loved doing for the LDF was working on appeals, and I realized I could do that for them and for other civil rights groups as a professor. I can write nearly as many briefs for them as a law professor as I did when I was actually there. Just last year, I worked with them on four cases.

So you've continued to be actively involved in voting rights litigation as a professor?
Yes. And voting rights cases have turned out to be a perfect kind of case for me intellectually. They raise really interesting questions: for example, which groups of people should be represented in the political process? That question can be debated at a philosophical level, but at some point we have to decide how our answers are to be translated into practice. Do we decide that only geographically related groups of people are to be represented, and use voting districts as the sole means to elect representatives? Or should we give people who do not live together but who share concerns a common voice in government, and so elect representatives "at large"? Several alternative representational systems have been suggested.

The Supreme Court has also been wrestling with a legal doctrine called "standing," which refers to the question of who can sue in a given situation, and I have been involved in several of those cases. With respect to election law, the problem of standing translates into questions such as if people don't like the way a voting district is drawn, who can sue? Anyone in the state? Only the people who live in that district? Only people who were personally put in or out of the district when the lines were redrawn? I've spent a lot of time, both as a litigator and a scholar, writing and thinking about these issues. A nice thing about doing litigation as well as scholarly writing is that my scholarship informs what I do in my practice, and my experience in court shows me the problems that need to be addressed by scholars.

Are law professors expected to do litigation or appellate work as well as scholarly writing?
No. Probably 90% of law professors never appear in court. The types of problems they study tend to be divorced from the questions that are currently being litigated, so they usually don't have much to say to practitioners. Most law professors are scholars first, teachers second, and practitioners a distant third or fourth. I'm atypical in that regard.

Do you enjoy the teaching part of your job?
Very much. There are two very distinct pleasures to teaching law. One is the pleasure you get from teaching first-year students, where you watch them develop as legal thinkers. It's wonderful to watch students learn to make legal arguments.

The pleasure you get from teaching upper-level law students is different because by then you can discuss emerging issues

in the law with them. Especially at a place like Stanford, the students are smart enough to figure out what the rules are. What you want to explore with them are the hard issues: Where is the law not entirely clear? Why is it unresolved? Where does it contradict itself? Your students are partners in an exploration of hard issues, and you get a lot intellectually out of the interaction, in addition to the pleasure of seeing them develop.

In November, your class on civil procedure must suddenly have taken on a relevance and an immediacy that it never before had.
It certainly did. As an intellectual puzzle and as a means to teach students an amazing amount about civil procedure, the Florida election contest was a wonderful opportunity.

As an expert in election law, were you surprised by some of the problems that came to light?
I've written a book called *When Elections Go Bad*, and elections have gone bad in all sorts of ways. In one case, the voting machines were actually set up wrong, so that when you pulled the lever for "X," it registered a vote for "Y." There have been badly designed ballots and problems with voting machines in the past, just not in a close presidential election. Nor have we ever seen such a convergence of problems. Meteorologists talk about a "200-year flood," one that can only occur when many low-probability events occur simultaneously. This was such an election.

The fact that we live in an age of instant news made people much more aware of what was going on. If this had happened in 1876, which was the last time we had a real meltdown in a presidential election, it would have taken longer for people to find out what had happened, and things would have moved more slowly.

The speed with which suits and counter-suits were filed and rulings were made was truly amazing.
It was like speed chess, which is a different game from chess. And I think we saw the effects of that rush, that lack of time for reflection, in some of the decisions that were made.

What did you think of the Supreme Court ruling?
I was upset by their treatment of the equal protection clause. They said that there was an equal protection clause violation—because different standards were being used in the recounts in different counties—without recognizing two very important things. The first was that the difference in the recount standards was dwarfed by the differential likelihood that a vote would be counted in the first place in a punchcard county versus an optical scanner county. Voters in punchcard counties were an order of magnitude more likely to have their votes misread or not counted at all. And indeed, people have already begun to bring lawsuits about this very issue. The Supreme Court focused on a molehill and ignored a mountain.

The second thing that was upsetting is that when the court finds an equal protection violation, its job is to cure it—to find a way that everyone gets treated equally. That's not what the Supreme Court did. They simply stopped the recount; they didn't fix the process. I know people were impatient for the process to be over, but we had legal mechanisms in place to handle the situation had the recount continued past December 12th. And I think the upshot of having a full recount would have felt more legitimate than having the Supreme Court stop the process.

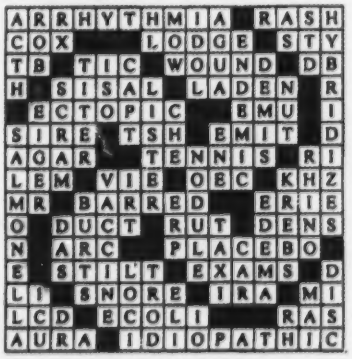
Earlier this century, Justice Jackson cautioned that just because the Supreme Court has the last word, they are not necessarily right. He wrote, "We are not final because we are infallible; we are infallible because we are final." In this case they were quite final, but I think they were also fallible.

His remark reminds me of what a verbally attuned profession this is.
Yes, if you don't like words, this is a bad line of work. I like word play, and I'm always fooling around with the titles of my papers. Two of my favorites are "Still Hazy After All These Years" and "Just Politics?" I encourage my students to read poetry, because it helps them focus on the value of carefully chosen words.

Do you have any parting thoughts for students interested in a career in academic law?
You have to really love the law. That sounds self-evident, but I see a lot of students who think about being a law professor because they like law school but don't want to practice law. That's a mistake. Being a professor is different from being a student. Unless you're a self-starter and you have the imaginative reach to think up topics that will generate good scholarly articles, it can be a miserable job. But if you like it and are good at it, it's the best job in the world. I feel incredibly lucky. It's been an absolutely right choice for me.

More about ... Idiopathic

It's hardly surprising that a profession so replete with technical terms would even have a technical term for "cause unknown." The Greek form of the word dates all the way back to Galen. *Idios*, Greek for "personal, private, peculiar to the individual," also appears in modern English in *idiosyncracy*. The same root was used in the word for a private citizen or layman, as opposed to an expert—an *idiotes*. In time, that term came to mean an ignorant person. The modern word *idiopathic* retains both meanings from its history: a condition arising from a cause peculiar to an individual, and a condition arising from an unknown cause—one of which we are ignorant.



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PLANNING AHEAD FOR COLLEGE

by Linda E. Brody, Ed. D.

Combined College/ M.D. Programs

On page 11 of this issue, Jeremy Collins describes his experiences as a student in the B.S./M.D. program at Northwestern University. If you are quite sure that you plan to attend medical school after college, you might want to investigate combined college/medical school programs as you ponder your college options. An increasing number of medical schools, in collaboration with either their own undergraduate college or other institutions, accept a small number of highly qualified students to pursue sequential undergraduate and medical degrees. Typically, students are accepted for these programs during their senior year of high school. A few programs accept students after enrolling at the undergraduate institution.

The primary advantage of these programs is that they relieve students of the stress of applying to medical school later. As long as your performance in the undergraduate part of the program is satisfactory, you are assured a place in the medical school class. You can also decide later to apply to a different medical school; most of these programs allow students to apply elsewhere if they so choose.

These combined-degree programs take from six to eight years to complete, which means that students who select the accelerated ones can reduce by one or two years the training required to practice medicine. Students who want a full undergraduate education before specializing in medical school can opt for an eight-year program but still benefit from the flexibility and ease of mind resulting from a definite acceptance into medical school.

Following is a list of combined college/medical school programs. For more information, see *Medical School Admission Requirements United States and Canada 2001-2002*, published by the Association of American Medical Colleges. To order a copy, see www.tomorrowsdoctors.org or call 202-828-0415.

Albany Medical College with Rensselaer Polytechnic Institute (7 years), Union College (7 years), or Siena College (8 years)

Baylor College of Medicine with Rice University (8 years)

Boston University (7-8 years)

Brown University (8 years)

Case Western Reserve University (8 years)

Chicago Medical School with Illinois Institute of Technology (8 years)

East Tennessee State University (8 years)

Eastern Virginia Medical College with the College of William and Mary, Old Dominion University, Hampton University, Norfolk State University, or Hampden-Sydney College (8 years)

George Washington University (7 years)

Howard University (6 years)

Jefferson Medical College with Pennsylvania State University (6 years)

MCP Hahnemann School of Medicine with Lehigh University (6-7 Years)

Meharry Medical College with Fisk University (7 years)

Michigan State University (8 years)

New York University (8 years)

New York Medical Schools (Albany Medical College, Mount Sinai School, New York Medical College, New York University, SUNY Brooklyn, SUNY Stony Brook, or SUNY Syracuse) with Sophie Davis School of Biomedical Education at City University of New York (7 years)

Northeastern Ohio Universities College of Medicine with Youngstown State University, Kent State University, or the University of Akron (6-7 years)

Northwestern University (7 years)

SUNY Brooklyn Medical Center College of Medicine with Brooklyn College (8 years)

SUNY Stony Brook (8 years)

SUNY Syracuse College of Medicine with Binghamton University (8 years)

Texas A&M University (6 years)

UMDNJ–New Jersey Medical School with Boston University, Drew University, Montclair State University, New Jersey Institute of Technology, Rutgers University–Newark, Stevens Institute of Technology, The College of New Jersey, or The Richard Stockton College of New Jersey (7 years)

UMDNJ–Robert Wood Johnson Medical School with Rutgers University (8 years)

UCLA College of Medicine with University of California Riverside (7 years)

University of California San Diego (8 years)

University of Cincinnati College of Medicine with University of Dayton, John Carroll University, Miami University or Xavier University (8 years), or University of Cincinnati College of Engineering (9 years)

University of Florida (7 years)

University of Illinois at Chicago (8 years)

University of Miami (6-7 years)

University of Michigan (8 years)

University of Missouri-Kansas City (6 years)

University of Rochester (8 years)

University of South Alabama (8 years)

University of Southern California (8 years)

University of Wisconsin (7-9 years)

Virginia Commonwealth University (8 years)

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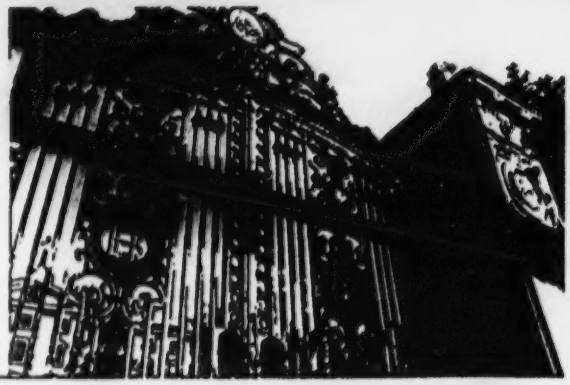
STUDENTS REVIEW

Brown University



The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 26 students who major(ed) in applied math (1), anthropology (1), biochemistry (1), biophysics (1), biology (2), classics (1), computer science (2), economics (2), education (1), English (1), French studies (2), geology (1), health & society (1), history (1), international relations (1), Latin American history (1), linguistics (2), math (1), music theory (2), neuroscience (1), physics (1), psychology (1), public policy (1), and Russian studies (1). Students' comments appear within quotation marks.

Quality of Academic Instruction for Undefgraduates

Brown has one of the most liberal curriculum policies around: no core curriculum, no distribution requirements, and no failing grades. While recognizing the dangers inherent in this sort of freedom, reviewers valued the freedom it gave them to shape their own education. They also spoke glowingly of the level of attention given to undergraduate education at Brown.

"Excellent. Brown's general attitude toward education is quite enlightened: students are expected to design their own educations to meet their own goals. We also have an unusual grading system: whether you take a course pass/fail or for a letter grade, if you fail, the course disappears from your record. This encourages students to challenge themselves in unfamiliar areas without worrying about hurting their transcripts. I think my education was a resounding success. I wish I could have had a few more years there."

"The absence of any required courses means that all classes are filled only with students who want to be there. People can also be creative and design their own major if they don't find one that fits their interests. Both of these features contribute to the overwhelmingly positive academic environment. The lack of required courses means that everyone who takes, say, a math class, is probably pretty good at math, or at least very interested in it; and that can be intimidating for students who are not confident of their abilities in that subject. But that's where the pass/no-credit option is so valuable, providing a risk-free environment for experimentation."

"The name 'university' is misleading, because in spirit Brown is a liberal arts college. Undergraduate education is the primary focus at Brown, and the quality of instruction is quite good. The faculty are very committed to teaching. I found professors to be universally friendly and accessible."

"One of Brown's unique offerings is its Program in Liberal Medical Education (PLME), an eight-year program in which students are accepted to Brown University and the School of Medicine in their senior year of high school. In essence, the undergraduate portion of the program is no different from a normal college life. Meanwhile, students are guaranteed admission to Brown's medical school. While many B.A./M.D. programs are accelerated, making it difficult for students to find room for non-premedical courses, PLME encourages students to gain a full undergraduate degree in any subject they choose, whether science or non-science. The mission of this innovative program is to produce socially aware and socially responsible physicians who not only have a mastery of the medical sciences but are also well educated in fields beyond medicine."

Social Life

Reviewers agreed that Brown offers a full and lively social life to its students.

"Freshman year was like being tossed into a living mulch heap: a mixture of as diverse a group of students as the admissions office could muster, and an extremely fertile environment for social growth. The social life is one of the main reasons I chose Brown. Whether you like to dance, go to plays, or protest labor violations, there is a lot to do."

"Brown is more social than the other Ivy League schools. With over 300 student-run organizations, there's plenty to do on campus—concerts, films, student theatrical productions, poetry readings, etc. And if you can't find something to do on campus, Brown is only five minutes by foot from the heart of downtown. Providence is a beautiful city, recently revived, with a strong cultural and arts community and many fine restaurants."

"Brown is a great place to be if you have an interest in serving the wider community. There are a lot of well-organized service organizations that work in the Providence community and beyond. The school really promotes these activities."

What Do You Like Best about Brown?

The curricular flexibility and open intellectual and social atmosphere topped the list.

"Most people are extremely motivated and happy to be here. This creates a wonderful, exciting atmosphere. I like the size, too—small enough that you see people you know, but big enough that there are always new people to meet."

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"I am really happy with Brown's program, with being given responsibility for my education, and with what I did with it. To me, an important part of college was being able to try what I wanted to try, no matter how it turned out. Brown really gave me that opportunity."

"The friendliness, enthusiasm, and intelligence of Brown students. And the freedom, both academic and social. The atmosphere is one of open-mindedness, culture, and political activism. You can do whatever you want to do; no one will frown upon your choice of lifestyle. It's a great place to find out what you really believe and what you're passionate about."

"I feel very lucky to be in a place where I don't have to defend my liberalism, where a liberal viewpoint is the *starting point* for discussion. Where the conversation quite naturally turns to topics like the changing portrayal of gay life in the media, or gender issues in computer science, or where to get the best organic tomatoes."

"I particularly appreciate the PLME, which allowed me to complete a B.A. in economics, study art history and architecture, and spend a semester abroad in London. I had the chance to do everything I wanted to do without worrying about applying to medical school. Now that I'm in the medical portion of my education, I further appreciate the closeness of my PLME class—we've already been together for four years."

What Do You Like Least about Brown?

While Brown's curricular flexibility can be liberating, reviewers note that freedom can be ill-used or abused and that students may need good advising to help them make the most of it.

"Some students are not ready to take responsibility for themselves. At Brown, you can float through, take really easy classes, and get little out of college. It's your choice—you can waste the many opportunities Brown has to offer."

"Brown is criticized for not being rigorous, and it can be. By giving students the opportunity to design their own educations, Brown sometimes allows those educations to be haphazard and without focus."

Who Would Be Most Compatible with the Academic and Social Atmosphere at Brown?

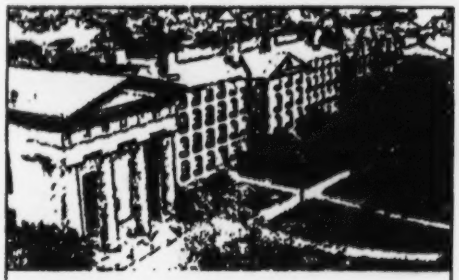
Reviewers again emphasized the maturity required to use, not abuse, Brown's flexibility, and the politically liberal atmosphere.

"Someone who is prepared to think about the education they want. The advantage of Brown's design-your-own curriculum is that the college doesn't choose what you learn—you choose for yourself what you want to know and carry with you for life. But making good use of that freedom requires maturity."

"Some of my friends felt lost freshman and sophomore years because they were not used to taking so much responsibility for themselves. I got a lot out of Brown, but I put a lot into it. That's part of Brown's philosophy—that you take responsibility for your education. I see that as a strength of the program, not a weakness. But it's not for everyone. Some people do need more structure."

"Self-motivated. While academic standards at Brown are high, the learning environment is not a pressure cooker. There is little competition between students; most drive is internally generated."

"Open-minded. Respect for diversity is very important. Bigots, homophobes, and chauvinists are far less welcome here than at many other schools. A student who is ready to take part in events with a diverse population will do well here. In this community, there is a spot for just about everyone who wants to be a part of it."



BROWN UNIVERSITY

Providence, RI 02912
(401) 863-2378

- 4-year private coed university
- Campus in the "College Hill" section of Providence.
- Full-time undergraduate enrollment 1999-2000: 2,766 men; 3,069 women.
- Special features: For more about PLME, see: biomed.brown.edu/Medicine_Programs/PLME.html. The Rhode Island School of Design (not affiliated with Brown) was referred to by one reviewer as "a happy nearby resource."

If You Had It to Do Over Again, Would You Go to Brown?

All respondents enthusiastically said yes.

"Absolutely. I can't think of another place I'd rather be. I grew more there than anywhere else in my life. It's a place that promotes thinking. If I had it to do over, I'd choose Brown again and love it even more the second time. I recommend it to people all the time, but always with the caveat that you have to be sure you want that much responsibility."

"Definitely, with no reservations. Brown is a place where you are constantly shifting your views, ideas, perceptions, and paradigms of yourself and society. Being at Brown has made me happy to be in the minority, to think in a way that may bring quizzical looks from others. When I emerge from here, I know I will continue to question myself and the world."

"Yes. I have found a home here. Brown is full of adventurous, spontaneous people whose hearts are in the right place. I am proud to be here. Come enjoy this crazy place—bring new ideas to it, change it, and share in this intellectual orgy."

As you try to find the college or university best suited to you, the views presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different school. At any college, it is important to seek out challenging academic experiences and to create a social life that fits your personal style.

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

BEST COPY AVAILABLE

A Message for Serious High School Historians

***The Concord Review** is the only scholarly journal in the world dedicated to publishing history research papers by high school students. Articles in **The Concord Review** average 5,000 words, with endnotes and bibliography. Essays may be on any historical topic and are selected for publication based on scholarship, historical interest, and quality of writing. Published since 1987, this quarterly journal has featured articles by students in 39 states and 32 other countries.*

*Articles published in **The Concord Review** are also considered for one of four Ralph Waldo Emerson Prizes ($3,000 each) awarded annually. Students should visit www.tcr.org to learn more about **The Concord Review**, to read the Emerson Prize winning essays, and to order a sample issue of the journal.*

*For this issue's Coach's Corner, we asked Will Fitzhugh, Editor of **The Concord Review**, to discuss the competitive nature of becoming published in this prestigious journal.*

by Will Fitzhugh

Samuel Johnson once said, "A man will turn over half a library to produce one book." A 5,000-word history paper should require less reading than that, but the papers published in *The Concord Review* were written, for the most part, by diligent high school students of history who had read a good deal about their chosen topic before they even decided what made sense to try to write about.

The nice thing about reading a lot, and of course then thinking about what you have read, is that the chances are excellent that you will have something you want to tell a reader about what you have discovered. You will also be more likely to have acquired some of the humility that comes from at least a glimpse of how much more there is to understanding the topic than you have had the time to give it. Princeton professor of history James McPherson, in the introduction to his excellent history of the United States Civil War, points out that there are about 50,000 books on this war, so even a fine scholar must be a bit modest when his own contribution is made.

Papers we don't consider for publication in *The Concord Review* are those that attempt to substitute politically correct sentimentality for the hard work of historical study and expository writing. Having the right sentiments is no substitute for trying to understand what really went on. Not that the expression of some opinion or judgment is to be ruled out, it is only that any such expression should be based on a lot of reading and reflection which has preceded it.

It can be difficult to estimate the quality of the competition for publication in the only quarterly journal in the world for the academic history papers of high school students. Consider, if you will, the amount of effort that high school students put into the Olympic Trials or the Intel Science Talent Search, sometimes working more than a year, sometimes for several years, on their attempts to be included. The 660 essays submitted each year to *The Concord Review* come from those students who have put enough effort into their work that they feel confident entering it into serious scholarly competition.

The purpose of *The Concord Review* is not only to recognize the best work in history being done at the high-school level in the English-speaking world, but also to distribute this work to lots of other students, to give them more interesting history to read and to reveal to them that some of their peers are taking history very seriously indeed and to get them to think about whether they might want to do the same.

More and more admissions officers at the best colleges in this country are coming to know and respect the academic standards set by *The Concord Review*. Fifty-eight of our authors have gone to Harvard, 50 to Yale, and 21 to Princeton. For those willing to do very hard work in history, the rewards are there.

THE NATIONAL WRITING BOARD

In 2000, *The Concord Review* began offering a new service, the National Writing Board, which rates serious academic papers by high school students of history against an international standard. These ratings will be offered to college admissions officers to help evaluate prospective students. Colleges who have expressed interest in receiving these ratings include Yale, Harvard, Princeton, and Northwestern Universities. Students may submit their work in two categories: short papers (1,500–2,500 words) and long papers (4,000– 6,000 words). The next submission deadline is June 15, 2001.

For more information about The National Writing Board, visit www.tcr.org or write NWB, P.O. Box 800, Sudbury, MA 01776.

Creative Minds

Scholastic Arts and Writing Awards

Each year, 250,000 students in grades 7-12 submit their work in writing and the visual arts to the Scholastic Art and Writing Awards. About 30,000 of these entries advance to national judging. More than 1,000 awards—including cash, scholarships, certificates, and exhibition or publishing opportunities—go to the national winners in sixteen visual arts and nine writing categories.

The works on this page won some of the most prestigious awards in the 2000 Scholastic Art and Writing Awards. You may view others, as well as read winning entries in various writing categories, on the contest's Web site. For more information: *The Scholastic Art and Writing Awards, 555 Broadway, 4th Floor, New York, NY 10012; (212) 343-6493; www.scholastic.com/artandwriting/*

Katy Townell, 13
"The Missing Bridge"

Jill Raymond, 17 "Evanescent"

Brian Neibright, 18 "Jungle"

Elizabeth Bares, 18
"Self-Portrait"

Tom Liska, 18 "Psyence Fixtion"

Ida Tate, 16 "Self-Portrait II"

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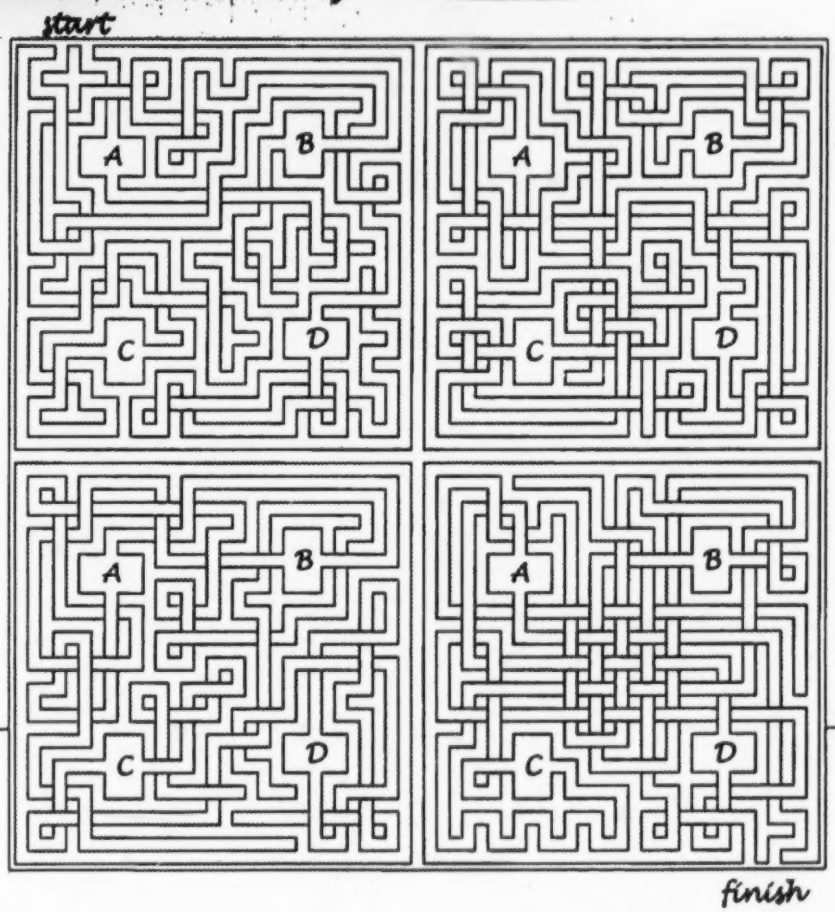
Knossos

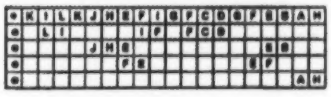
by Tim Boester

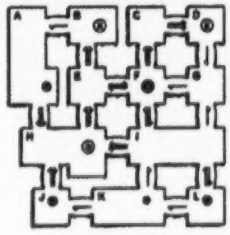


This labyrinth has four quadrants. Movement between quadrants occurs via the lettered rooms. When you arrive at a lettered room, jump to the same lettered room in the next quadrant, moving clockwise around the puzzle. You must jump when you reach a room; you cannot simply pass through it.

A graduate student in educational psychology at the University of Wisconsin, Tim Boester now has additional puzzles on his home page: http://homepage.mac.com/boester

Solution to Knossos Games in our January/February issue:





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Imagine...

OPPORTUNITIES AND RESOURCES FOR ACADEMICALLY TALENTED ... Volume 8 Number 5 • May/June 2001

Focus on The Web

Top-Notch Distance Learning Programs

News from the Intel Science Talent Search

The Art and Sport of Ballroom Dance

Students Review UCLA

Published by JOHNS HOPKINS ... Center for Talented Youth

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ImaGiNe...

Opportunities and Resources for Academically Talented Youth*

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May/June 2001
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Editor	Melissa Hartman
Assistant Editor	Michelle Burkhart
SET Director	Linda E. Brody, Ed.D.
Research Associate	Carol C. Blackburn, Ph.D.
Editorial Assistant	Vicki Moore
Student Assistant	Aaron Back
Designer	Tempest Design Group

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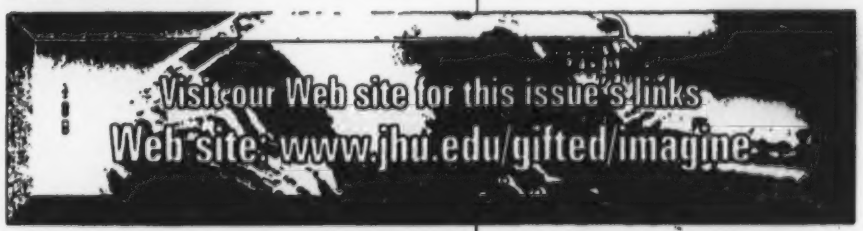
Address editorial correspondence to:
Melissa Hartman
SET/CTY
The Johns Hopkins University
3400 North Charles Street
Baltimore, Maryland 21218
(410) 516-0300 • fax: (410) 516-0108
e-mail: mhartman@jhu.edu



ANNOUNCEMENTS

See You in September

We hope you have an exciting summer planned. Here at *Imagine*, we use those months to get started on the next volume year—we conduct research, make contact with student writers, and work on ways to continue improving the magazine. We're looking forward to spending the summer preparing for the great lineup of topics we've set for the 2001–2002 volume year:

September/October	Dramatic Arts
November/December	Physics & Astronomy
January/February	Communications
March/April	Politics & Law
May/June	Robotics

If you have a story idea for any of these issues, now is the time to let us know! Send an e-mail to the editor, Melissa Hartman, at mhartman@jhu.edu or send her a letter at SET/CTY, The Johns Hopkins University, Baltimore, MD 21218.

Made to Order

We've made it easy for you to make sure you're onboard for another year of *Imagine*: Just use the postage-paid envelope in the center of this issue to renew your subscription.

You can also use this envelope to order a subscription for friends or relatives who would enjoy the great articles and advice you find in *Imagine*. The gift of *Imagine* is perfect for summer birthdays—and it lasts for a whole year. When we receive your order, we'll send your gift recipients a letter with details about the subscription you have ordered for them.

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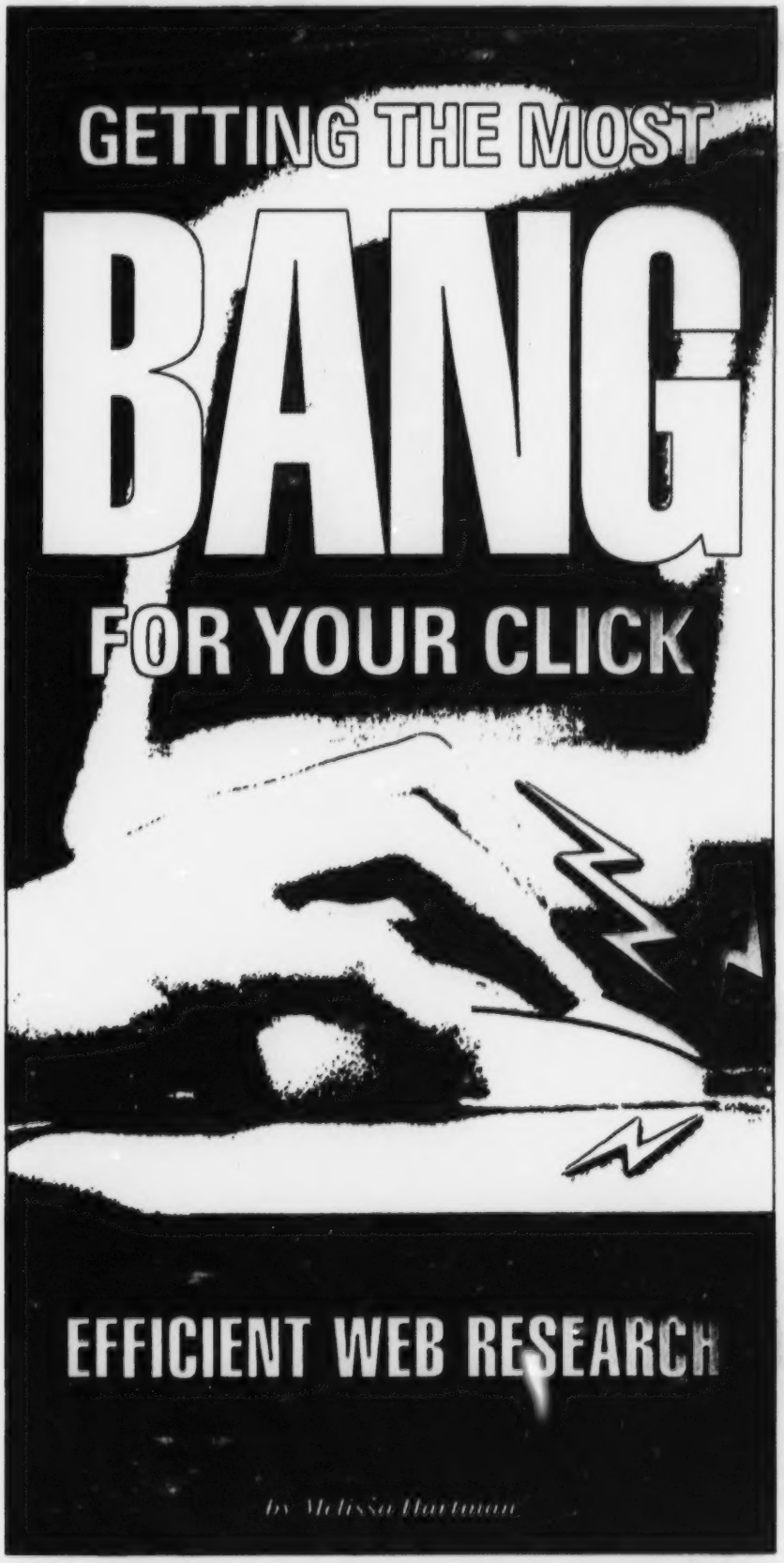
Last Call for Readers Panel

We're looking for 6-10 readers to help us make *Imagine* even better! By sharing your ideas with the editorial staff and other panel members, you can help us shape a whole year's worth of issues. Just send us a paragraph critiquing this issue and making suggestions for improvement, or just offering your general impressions. Be sure to include your age, grade, and address.

E-mail your paragraph to Michelle Burkhart at miburkha@jhu.edu or mail it to her at SET/CTY, The Johns Hopkins University, Baltimore, MD 21218.



Whether you're looking for sources for a school project, comparing colleges you might apply to, or looking for productive ways to spend your summer, the Internet is an invaluable tool. But the information you need isn't always just a click away, and some of it you might not find at all if you don't use the right tools to search for it.

Loading Web documents takes time. Reading them takes even more time. If you're working within any kind of time constraints, you need to limit the number of pages you read—but you also need to know that you're reading the best of what's available. Honing your search skills can help you find the best information on the Web, more quickly.

Getting Started

Before you even launch your Internet browser, do a little planning. You will need to know what kind of information you're looking for—e.g., biographical information, statistics, critical reviews, scholarly articles—and how you are going to look for it.

Suppose you were assigned a paper on a 20th-century British writer. Before you begin, you might narrow your search by deciding what kind of writer to write about—poet, novelist, essayist? You might take a look in an anthology to find out who was writing in that genre in that century, or you might simply choose someone whose work you like. Suppose you settle on novelist Muriel Spark. What kind of information do you want to look for? Biographical? Critical interpretations of her work? A list of her novels? Or perhaps you want to compare her with another novelist, Fay Weldon. Think it through before you go online.

Subject Directories and Library Gateways

If you're having trouble getting started, preliminary browsing on the Web can help you think about your search strategy. If you are researching a topic of general interest, subject directories like Yahoo! can be valuable. Under each general category are topics that become more and more specific

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as you click along, which makes these directories a useful tool for narrowing the topic you want to research. Most subject directories are searchable, but because they are created by humans, their databases are small in comparison to those of search engines like Google, which have computer-generated databases. They are also not updated as frequently, which can result in a lot of dead links.

If your topic is more academic, as in the case of our paper assignment above, opt for a library gateway instead of a subject directory. Because they are compiled by librarians and other experts who know where high-quality information exists, gateways are invaluable tools for academic research. The sites indexed in the gateways have been evaluated for their usefulness, and most gateways annotate their listings, which makes it even easier for you to decide which sites are relevant to your particular research.

Using Search Engines

Search engines such as Alta Vista, Google, and Northern Light are probably the best-known and most often used tool for searching the Web. Search engines work by sending out "bots" or "spiders" that crawl through Web pages and index the words they find on them. The spiders keep track of the links they encounter and eventually visit those pages for indexing. For a site to become part of a search engine's database, another page must link to it, or the page's author must submit it for indexing.

When you use a search engine, you search not the entire Web but only that engine's database. Search engines vary in how they index and rank the sites, so what you find using one search engine is not necessarily what you will find if you use another. For that reason, you should use more than one search engine in your research. You can also use one of many metasearchers, such as Dogpile, Ixquick, and Metacrawler, which submit your query to several search engines simultaneously. Metasearchers are a great place to start your Web research because they show you very quickly what kind of information about your topic is published on the Web. The disadvantage is that they present only a fraction of what each search engine finds, so plan to extend your search using other tools.

The quality of results you'll get using search engines and metasearchers depends greatly on the effectiveness of the keywords you enter. Instead of randomly typing the first words that come to your mind, think through your topic a bit. What keywords best define it? For our paper on Muriel Spark, we'll obviously want to use the author's name in our search, but what else? Try to focus on nouns, and try to come up with at least four of them. The law of inverse proportions applies here: too few keywords will give you too many returns; too many will yield too few.

Type your most important keywords first: muriel spark novels criticism (using lowercase ensures that both upper and lowercase will be searched). If you want to look for a specific phrase, enclose it in quotation marks ("the driver's seat by muriel spark"). If you want to require that a particular word or phrase be included in the results, put a plus (+) sign in front of it ("muriel spark" +"fay weldon"); put a minus (-) sign in front of those you want to exclude. These symbols, called implied Boolean operators, are recognized by most search engines' basic searches. Quotation marks and the plus and minus signs are sufficient for most basic Web research.

As your research progresses, however, you should experiment with the advanced search options offered by most search engines. By allowing you to give more specific rules to the search engine, advanced queries return more relevant hits, which again saves time.

Searching the Invisible Web

Search engines differ in how they index Web pages, but all of them are limited to pages that are static and linked to other pages. According to BrightPlanet.com, those pages number more than one billion (based on the size of Google's database, currently the largest of all the search engines). But this number does not include files in formats other than HTML, such as PDF or MPG, and it does not include the content of searchable databases. To access that content, a person would have to query the database directly; the information is not contained on individual pages. In 1994, the term "invisible web" was coined to describe the information that is not visible to the search engines. BrightPlanet.com calls this information "the deep Web"—it is visible, but only if you use different search technology—and estimates that the deep Web is 500 times larger than the "surface Web" that is indexed by the search engines.

So how do you delve into the deep Web? Some of the search engines are beginning to include previously hidden sites, and the gateways will lead you to many of these sites as well. You can also use some of the relatively new tools designed specifically for searching the invisible Web, such as the Invisible Web Catalog and CompletePlanet. These tools will lead you to archives, specialized databases, mailing lists, and discussion groups you might not find otherwise. Databases exist on almost any topic you can think of, from scholarships to poetry to patents. As your research progresses and becomes more focused, explore the deep Web resources on your topic. This part of the Web is growing even more quickly than the surface Web, so more and more information is sure to become available as search technologies advance.

Like skills in music, athletics, and writing, your Web research skills will improve with practice. The more you experiment with different search tools and strategies, the better you'll become at locating the most informative sources on the Web, and the less time you'll spend finding them.

And what will you do with all that free time? If you need ideas, I'm sure you'll find something at Yahoo!

See page 19 for our recommendations for search engines, online libraries, gateways, and more.

Anyone can post a Web document, and that's a good thing. This means that you have access to diverse perspectives on almost any topic you search. Wondering what life is really like at your dream college? It's easy to find opinions on the Web from professors, students, admissions offices, athletic departments, college presidents, alumni, journalists. You can compare admissions statistics of a variety of schools. You can find out which are highly rated in your fields of interest. All good, right?

Yes and no. This variety can also make your life as a researcher much more difficult. Even if you conduct your Web searches in the most academic way and with the best intentions, you might still end up with information that is outdated, biased, or just plain inaccurate. That's why, instead of just walking away with printouts of pages that match your queries, you should take the next step: make sure the information on those pages is credible.

EVALUATING WEB DOCUMENTS

by Melissa Harrison

Who Published It—and Why?

If an author is identified, is it a name you recognize? If the author is an expert in the field, you have probably seen his or her name elsewhere in your search. If not, try searching it in Alta Vista. This will lead you to other papers written by the same author and may provide other useful information, such as organizations with which that author is affiliated. If you can find nothing else about this author, he or she is probably not an expert in the field. Be especially cautious if you find no bibliography and no references to known experts.

If you cannot identify the author, find out as much as possible about the publisher. First, look at the page's URL. If the domain name ends in *edu* (educational site, as in www.jhu.edu), *gov* (government, as in www.nasa.gov), or *mil* (military, as in www.navy.mil), you can probably consider the information you find there reliable. If the domain name ends in *org* (non-profit organization), *com* (commercial), or *net* (networks, internet service providers, some organizations), you may need to be more critical. If you can't figure out who has published the page by looking at its domain name, go to www.betterwhois.com to search it. There, you can find detailed information—including phone numbers—about who owns that domain name.

If an organization has posted the page, find out as much as you can about them. You should be able to find a link to Mission, History, or About Us; follow those links and look for evidence that the organization is legitimate. You should also be able to find contact information easily on the organization's home page. If you can verify the credibility of neither author nor publisher, don't trust the information you find on the page, no matter how convincing it seems.

Why Is It Here?

Now that you know who put the information on the Web, ask yourself why. What does its purpose seem to be—to inform, to persuade, to sell? Look for text that is objective and balanced. Text that conveys a strong opinion—either positive or negative—is probably not giving you the whole story. Consider the author's or publisher's relationship to the issue. Do they provide only examples that support their own cause?

Good sources will provide information that is not only relevant and unbiased, but also current. Many pages include a line indicating when they were last updated. In addition, if you are looking at statistics or research findings, you should find clear references to how and when the data was collected; don't blindly accept numbers without knowing how they were gathered. It will make a big difference even in an opinion poll whether 100 or 1,000 people were interviewed, and whether the questions were asked yesterday or five years ago.

How Did You Get There, and Where Will You Go?

If you found the site using a search engine, you will know nothing about it until you look at it. If you found it through a library gateway, you will know that someone has already assessed the site and found it valuable and relevant. Even so, you should evaluate the site yourself in terms of your specific research.

Often in Web research, a series of clicks on links leads you to a page you wouldn't find through a search engine or gateway. Consider the page that led you to where you are now. Links from NASA's Web site, for example, are pretty reliable. But if you linked from a site about which you had any reservations, you should remain skeptical about the linked pages.

Links can say a lot about a site. If you are looking at a page posted by a questionable author or organization, follow some of the links. Do they lead to respected organizations, experts, or publications—or to similarly questionable sites? You can also tell a lot about a site by seeing who links to it. Just do a link search in Alta Vista by typing *link:* followed immediately by the URL of the site (example: link:www.jhu.edu/gifted/imagine/). Again, look for reputable publishers.

Many Web pages will fall quickly into two piles on your desk: "great sources" and "no way." It's the pages that don't sort so easily that you'll have to spend the most time evaluating. You might have to make a trip to the library to read what else the author has written, or you might have to ask your teacher whether 10-year-old statistics are valid for your project. The bottom line is this: use only those pages that end up in the "great sources" pile. The more research you do, the easier it will become to see quickly and clearly which Web pages belong there.

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BeachNet

A Computer Nerd's Dream

If you want real-world computer experience, you may have to look no further than your school. With more schools becoming more wired every day, many students are finding opportunities to design Web sites, teach software applications (often to teachers and administrators), troubleshoot network problems, or even, as Glenn Willen describes in this article, help provide Internet service for an entire school system.

by Glenn Willen

I have always been a computer nerd, so when I heard about an opportunity to work at an Internet Service Provider (ISP), I jumped at the chance. Here was my opportunity to work with the same equipment that the professionals from companies like Cisco and Sun Microsystems use—to have all the experiences and all the responsibilities of working for an ISP—but at my high school.

BeachNet was founded at my school, Redondo Union High (RUHS), in the spring of 1994 as an experiment in student-run Internet service. Its founder has since moved on, but BeachNet has continued to grow and improve over the years. It is now run by 16 students with two faculty sponsors. Our job is to keep the network, which provides Internet service to about 15 schools in the Redondo Beach and Hermosa Beach school districts, up and running. All Internet service—from the student computers in school libraries to the principals' personal computers—at every school in both districts goes through us.

When I first joined BeachNet early in my freshman year at RUHS, I had a rudimentary knowledge of programming and networking from reading computer books and from experimenting with my home computer. But I had no real-world computer experience and no skills whatsoever in dealing with people. My work at BeachNet started with taking technical support calls. I have always been uncomfortable calling tech support, but it is even harder being on the receiving end of a call. Many of the people calling us for help have almost no computer skills at all, and one of the first things I learned at BeachNet was how to calmly instruct these people exactly how to proceed without becoming frustrated with them. Most of the calls I took were from people who had questions about the basics of Windows and other things I already knew. I asked the managers for help with the ones I couldn't answer myself, learning more every time.

Another thing I learned in my first few weeks at BeachNet was how to program for the real world. All the programming I had done up to that point was theoretical: how can I sort these numbers the fastest or solve this puzzle in the least moves? At BeachNet, I learned how to program "defensively." For example, if a visitor to our site enters his or her year of birth as 2030, or more creatively yet as "xyzz" or -12, the program shouldn't crash or accept bad data, but should politely ask the user to reenter the information. Real-world problems like this are invariably more complicated than textbook ones. And perhaps that's why employers seem to look favorably at BeachNet on a résumé: several of our former managers have gone into high-paying, high-tech jobs right out of high school.

BeachNet also gave me my first practical experience with networking. The greatest challenges I've found are configuring computers to interact with the Internet and configuring high-speed connections between remote locations. We often have to make trips to other schools to configure their equipment to match ours, and sometimes problems appear that no one on our staff can figure out. Most recently this happened while setting up a high-speed line between two schools, which I was given the task of fixing. Fortunately, no field trips were required—just a call to Cisco technical support to learn about a few obscure options in their equipment. A few tweaks using the advice of the Cisco technician, and the line was up and running.

Once my on-the-job training in networking and programming was complete, I was promoted to the next level: Network Specialist. As an NS, I no longer had to answer technical support calls and instead was able to concentrate on learning the ins and outs of the system. By the beginning of my sophomore year, I was promoted to the top level of BeachNet staff: Network Manager. As one of BeachNet's five managers, I have all the rights and responsibilities of a system administrator in a large corporation—I can do absolutely anything with any of our computers, such as installing programs on our main server. I also have to keep the computers running all the time, and if they stop working, I have to be ready to fix them at any time.

I have sacrificed a lot of my free time for BeachNet, but it has been worth it. I spend about two hours after school every day working for no pay, but I get valuable experience that might lead to a great job. Just as importantly, I really enjoy it. I am, after all, a computer nerd at heart.

*When he's not working at BeachNet, **Glenn Willen** is active in Boy Scouts. Glenn hopes to major in computer science in college, earn Microsoft certification in networking, and become a computer consultant.*

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When an intrepid information analyst with a background in library science and a passion for classifying information joined forces with a team of software engineers, the result was a better search engine for everyone.

by Joyce Ward

The Web is the most comprehensive, universal, integrated information resource ever assembled—a massive digital library, estimated at 1.5 billion discrete Web pages, of information from all countries, in all languages. It contains not only text but also graphics, audio, video, and other media. Just as importantly, it is the most comprehensive entryway to library catalogs, document archives, and databases (the "invisible Web") in electronic form.

In some ways, though, the Web is a step backward in the annals of information organization. Unlike library collections, the Web's contents are unregulated and unorganized. No librarian acts as a "quality control" gatekeeper who decides what information is valid and valuable enough to be included, nor is there any formal indexing system that facilitates the search process. Trying to find something on the Web can be a frustrating endeavor. Web searches can generate voluminous, undifferentiated lists of results, and most Web search engines offer few tools to help users find the most useful "hits."

Where Information Worlds Collide

In January 1996, I linked up with five engineers who were, like me, dissatisfied with the state of Web searching. We agreed on two fundamental improvements we wanted to make. First, we wanted our search engine to include "meatier," more high-quality resources—the professional journals and other resources found in libraries. We didn't want to have to perform separate searches on the Web and in library catalogs; we wanted to consolidate the process. The disjunction between the Web and the formal reference literature was a by-product of the way the Web developed, but it was an unnecessary one because the technology to merge those literatures existed.

In creating Northern Light, we assembled a collection of knowledge that had never existed before—a conflation of Web, journal, and reference literature. It now includes about 325 million Web pages and 27 million licensed, full-text documents from 7,000 providers. We have integrated these resources into a single, searchable database.

The second thing we wanted was to improve the search process itself—to make search results more useful and useable. To do that, we decided to classify documents in several different ways: by *subject* (about quarks, Nathaniel Hawthorne, cholera); by *type* (as a journal article, personal home page, product review); by *source* (from a professional journal, NASA, www.playtherapy.org); and by *language*. This classification information is then used to organize search results.

Knowing that we wanted to classify all the documents in Northern Light was one thing. Doing it was another. Because our database encompassed a much wider array of resources than a library does, we couldn't use any pre-existing classification schemes; we had to develop our own. We spent months examining and integrating classification schemes—from the Dewey Decimal system and the Library of Congress subject headings to the aisle headings of drugstores—to create one that reflected the diversity of the resources included in Northern Light.

We also realized that, with the size and growth rate of the Web, we would need to automate the classification process: we would need artificial intelligence systems to do the work. While it's possible to manually classify several million Web *sites*, as does Yahoo!, it is not feasible to manually classify the more than one billion *documents* on the Web. We spent four years developing, training, and refining the artificial intelligence agents that classify documents for Northern Light's database. At this point, we've classified nearly 100 million documents, with fewer than ten people training the system that does the actual classification.

What Are Those Folders?

When a user launches a search in Northern Light, the engine retrieves documents matching the query, then does an additional step: it finds

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prominent themes or similarities within the retrieved documents and clusters the documents on the fly, creating virtual "folders" of related documents that pop up on the left of the screen. The folder labels may indicate that the documents are about the same subject, of the same type, in the same language, or from the same source. The predominant categories become the first set of folders that pop up with search results. When a user opens a folder, its contents are sorted again and a new set of folders is displayed.

Some users never open those folders. They may think they are ads and ignore them, or they find what they're looking for in one of the first few documents on the results list, and have no need to do any further delving. But for some queries, the folders are crucial to harness the real power of Northern Light's search capabilities. Folders organize, filter, narrow, and limit search results. For example, they can:

• *Help you investigate subtopics of a broad topic.* A search on "bioremediation" yields folders on "Water pollution," "Soil remediation," "Hazardous waste," and "Agricultural biotechnology."

• *Disambiguate multiple senses of a query.* If you enter the word "depression," Northern Light will respond with subject folders that include "Depression and mood disorders" and "The Great Depression." On the next keyclick, you can lock into the sense of "depression" that you intended.

• *Help you find documents from formal journal literature.* If you're looking for medical research on sleep apnea, clicking on the "Special Collections" folder will bring you directly to articles published in the *Journal of the American Medical Association.*

• *Limit results by language.* If you're searching for information on "glasnost," you can start with the folder "Documents in English."

• *Help you find people, businesses, and organizations.* If you'd like to gather personal accounts of veterans who served during atomic weapons tests, you can search on "atomic AND veterans." One of the source clusters brings you to the "Atomic Veterans History Project."

Through content classification and folders, Northern Light helps users navigate efficiently to the information they seek.

What's Next?

We are very proud of what we have created in Northern Light. However, we believe that practical automatic classification is still in its infancy. Over time, Web search tools will get even smarter and more personalized. For example, one enhancement we'd like to add is to classify documents on the basis of intended audience. The services that do that today all do it manually; a real person decides whether a Web site is appropriate for a K-12 audience or a CFO. Developing the capability to do that automatically will require breakthroughs in information classification technology.

We look forward to playing an active role in the development of technology to navigate "information space" —not the final frontier, but an exciting and ever-expanding one. Come visit us at Northern Light and enjoy exploring it with us.

***Joyce Ward**'s fascination with information retrieval stems from a life-long passion for reading everything from essays to Heath Kit catalogs. She is married and the mother of a daughter and son, both of whom also read while brushing their teeth. A former corporate librarian, she was a member of Northern Light's founding team, and is now Vice President of Enterprise Products there.*

Fetch!

I've spent so many hours training the Northern Light search engine that I sometimes think of it as my "cognitive pet." One of the things I like to do with it is to give it a question and say, "Let's see what you come up with." Go fetch!

Sometimes the search engine is so insightful that it's uncanny. When I asked, "Why are people homeless?" it came back with folders—"Domestic violence," "Affordable housing," "Floods," "Earthquakes," "Substance abuse"—that are all important aspects of the problem. Of course, it doesn't *know* that, it's just showing patterns; but at a certain point, that capability starts to look like intelligence. It even found facets of the issue that a sociology professor might not know about. A folder labeled "Buddhism" revealed that some Buddhists engage in voluntary homelessness. The things you learn from a search!

At other times, it's laughably off-base. I once asked, "What are the five boroughs of New York?" The first document it displayed had a picture of five 50-year-old guys in lounge suits, members of a band called The Five Boroughs. When we were first developing our classification system, we ran into this problem so often that I declared it a fundamental law of information science: for every concept you can think of, there's a band by that name. How do you fix this kind of problem? How do you teach a search engine that "the five boroughs of New York" is more likely to be a geopolitical boundary than a rock band? We can put in screens and filters to avoid common mistakes—the "Taj Mahal" classification has a little addendum in it: "not blues guitar"—but we can't anticipate every source of confusion.

And the training is never done. Concepts change over time, and you have to refresh your algorithms to keep up. Last year we trained the system to recognize the concept "reality TV" using documents about *Survivor* and other shows, but we've had to retrain on that concept to include this season's new shows and coming attractions. A Web search engine is a fascinating pet, but it's not a low maintenance one!

—Joyce Ward

BEST COPY AVAILABLE

king Sites That

You've probably encountered Web sites that were confusing and hard to navigate, or visually over-stuffed, or just plain ugly, or that took forever to load. And you probably haven't gone back to those sites if you could avoid it. Trying to get what you need out of a poorly designed Web site is frustrating.

A well-designed Web site, on the other hand, is a pleasure. It's a pleasure to look at and a pleasure to use—easy on the eyes and easy to navigate. Someone has clearly thought about what you might want to get out of that Web site and what would make your visit there effortless and enjoyable. That someone was a person like me.

I'm an information architect at Sapient, a top business and technology consulting firm. I spend my days designing Web sites and other online applications for businesses and organizations. I think about questions like: What is the goal of the site? Who are the intended users? What kinds of information should the site include? How can users find that information most conveniently? How can we make the site a positive experience for users? It takes analysis, planning, and many different kinds of expertise to answer these questions and create an effective Web site.

Building Sites

At Sapient, we work in teams of anywhere from six to sixty people whose expertise ranges from business to graphic design to programming. As the information architect, I play a central role in every project I work on and am usually involved from the very beginning to the very end.

The first step in the process is to understand what the client wants their new Web site or system to do. The lead team member in the initial meetings is likely to be a business strategist, who explores with the client how their industry is changing and how the Internet can help them accomplish various objectives. I sit in on those meetings and begin to think about how the Web site will be organized; I am the one who must translate their business goals and objectives into a usable site design.

Once we have a general idea of what's needed, our team converges on the problem, bringing our different perspectives and expertise. The graphic designer focuses on the look of the site and how to make that look reflect the client's goals and brand. A content strategist works with the client on the site's content. A user researcher (what we call an "experience modeler") develops a profile of the intended customer or user. That's an important part of site design. For the site to be user-friendly, we need to know just who the user is; we have to be aware of their level of computer expertise, the type of computer system they're likely to be running, how using the site will fit into their life, and what they will want from the site. For example, when designing an online investing application, I had to know whether the intended audience would be day traders, wealthy senior citizens, or investing novices. As you can imagine, different content and features would be appropriate for each of these audiences. Throughout our design process, we have prospective users test the site to see if it is indeed working for them the way we think it will.

My job is to create the site's architecture—the master plan of what the site will include, how things will be connected, what the flow of the user's experience will be. My specialties are in designing navigation systems for the Web and designing interface appearances and behaviors. Although I have a strong background in programming, I don't actually write the code for the site; like a building architect, I design a structure that someone else then builds. But even though I don't do the coding, my programming knowledge is essential to my work because I must know what I can ask of the programmers—what our options are, what capabilities we can build into the site, how much time it will take to do that. Often our sites must interface with a "legacy" system already in use by the client, such as the trading platform for the online investing application mentioned earlier. I needed to know what information that system could provide and how quickly, so I could organize that information to make sense when delivered over the Web.

My responsibility is ultimately to create a site that works from a purely technical standpoint and that meets the clients' and the users' needs. Technology folks on the team often want to keep the site simple so it is easier to build, clients often want to sell as many products or services as they can, and users often just want to get their information or complete their task and get on with their lives. I love the challenge of meeting all those very different objectives simultaneously.

Building Skills

Information architects come from many different academic backgrounds. Some, like me, are techies who became interested in design. Others come from business, design, or even psychology backgrounds.

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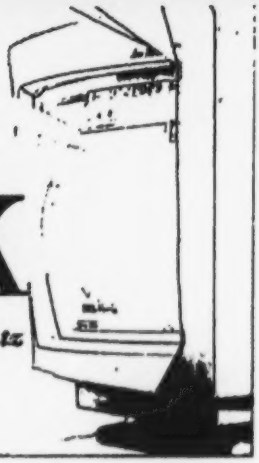
Work



by Nolan Glantz

I was a computer science major in college at Stanford. In my master's training, I specialized in human-computer interaction design (HCI), which is the study of how to design useful, usable, and intuitive interactions for computer users. The field is an interesting mix of graphic design, technology, psychology, marketing, and ergonomics. The training I received was ideal preparation for designing Web sites or user interfaces for other types of computer software.

While at Stanford, I also gained exposure to the business side of technology as one of the first students in an innovative program designed to train engineers to enter the entrepreneurial arena. Our first three months in the program were spent learning about marketing, venture financing, and other areas of entrepreneurship. We spent the summer working full time in a Silicon Valley start-up, then returned to Stanford to examine formally some of the lessons we had learned in the real world. My business education was thus very focused and very experiential, and it prepared me well for the world I work in now.

While there are many paths into this field, and no one "right" way to train for it, there are courses and other educational experiences that can be helpful to anyone contemplating this work:

• *Internships.* The best preparation is not a course at all; it's real-world experience. There is no better way to determine whether you will truly enjoy the business world than to try it out. Relevant work experience will also show you what additional skills you want to master while you're still a full-time student, and will make you more attractive to potential employers when you graduate. You can also usually earn a decent salary while learning on the job. Working as an intern was the best preparation I undertook during my school years.

• *Marketing.* The business world is pervaded by a marketing mentality, and being familiar with that way of thinking is a must. A marketing course will teach you that marketing isn't just about creating flashy ads; it's about knowing who your customers are and how to reach them.

• *Business management.* Some skills are socially acceptable to learn on the job. Web technology and software keep changing, so everyone in this environment is constantly upgrading technology skills. Management skills, on the other hand, are not as easy to learn or ask about on the job; they are assumed. Knowing something about management theory comes in handy, as does an understanding of the economic and business environment in which every company operates.

• *Visual creativity.* Even though we are a very visual culture, most of us never take courses that encourage us to cultivate our visual creativity, or that challenge us to channel it. One of the best courses I took in college was a "visual thinking" course intended primarily for industrial engineers, people who design physical objects. After having spent most of my schooling thinking logically and symbolically (in mathematics and programming), it was incredibly valuable to learn how to think and communicate visually. My design and brainstorming skills improved dramatically as a result, and these have proven to be a tremendous asset in my work life.

• *Team/project courses.* I hate to admit this, but some of my least favorite courses were ones in which I had to complete a project and/or to work in a team. Compared to the homework assignments in my other classes, the goals always seemed frighteningly fuzzy and open-ended. I liked the feeling of satisfaction that came from finishing a problem set, and I didn't get that from project courses. However, life hardly ever hands you a problem set. In the real world, most problems are fuzzy, open-ended ones that can be solved in many different ways. Even though I resisted those courses, they were among the best intellectual and emotional preparation I got for the kinds of challenges I now face and enjoy.

Today, when I remember how much I disliked project courses in school, I laugh. Now I love the struggle that comes from making tough trade-offs in situations with no right answer. I love the open-endedness that challenges me to be creative. And I love working with a team of people who bring different strengths and perspectives to the table. We have a synergy, and I am more creative with them than when I work alone. I love that together we create positive experiences for the people who will visit our Web sites. We are making the world a better place, one Web site at a time.

***Nolan Glantz** is a former athlete turned "computer geek." He spent a four-year leave of absence from Stanford competing on the professional racquetball circuit. After arm injuries ended that career, he finished his schooling and joined the computer software industry. He is currently a senior information architect at Sapient in Cambridge, MA. When he is not designing Web sites, Nolan is usually busy playing with his 18-month-old son, Zachary.*

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Embark to H

A LESSON IN WEB WIZARDRY

by Madeline Kunsberg

Over Christmas vacation, my family caught Harry Potter fever. Although never put online, we created an online version of the fictional game Quidditch, a wizard's sport played on brooms. My brother David spent three hours describing all the brooms Harry ever rode. And I spent days working with computer animation programs to create bubbling cauldrons and sparkling wands inspired by the series. So when my brother Ben stumbled into the world of Harry Potter role-playing sites during a search for Harry Potter merchandise, I had to check them out.

I discovered that role-playing sites are more content-based than chat rooms or message boards—some come complete with Internet games, fan fiction, and polls. But the more I looked, the more I saw sites that were full of misspellings and borrowed graphics or that had become outdated. I knew I could do a better job. And that's when Ben and I decided to create our own Harry Potter role-playing site.

The Plot Thickens

In the Harry Potter series, Harry attends Hogwarts School of Witchcraft and Wizardry, where students are divided into four different houses that compete against one another. I thought it would be fun to make Hogwarts an online school, where teachers post lessons on the Web, students submit homework, and scores are posted on a message board.

Ben and I hoped to follow the series's plot as closely as possible. We wanted to sort new students into houses and hold various competitions. We also wanted to create classroom activities in wizardry and a virtual Diagon Alley, a wizard's mall where students find quills, cauldrons, and other magical supplies. Although we knew what we wanted, getting to that point was another story.

Under Construction

In order to create our Web site, I had to learn HTML. I took a free crash course at Webmonkey.com and then began building our Web site using Microsoft FrontPage. Meanwhile, Ben and I were busy wading through text entry forms and inserting animations. Once we received the registration code for a domain name, we published our site and waited for our first hit. We posted the URL on a Harry Potter message board and continued to wait.

I was ready to give up when a stranger e-mailed us, letting us know that our site wasn't working. It turned out that our site was stored only on our hard drive and wasn't accessible to any other computer. To solve this problem, I signed up for 50 free megabytes of online space. It took me three hours to transfer our files, but finally our site was online!

Help Wanted

After the mix-up, Harry Potter fans ages 8 to 45 began logging onto our site. Three weeks later, we found ourselves managing a site with up to 1,000 hits a day and over 100 registered members from the United States, India, Austria, and England.

It was difficult to keep up. When new members complained they weren't getting sorted into houses fast enough, I had to enlist a friend's help. When we couldn't process the orders for wands, cauldrons, and dried dragon skins fast enough, I had to come up with another plan.

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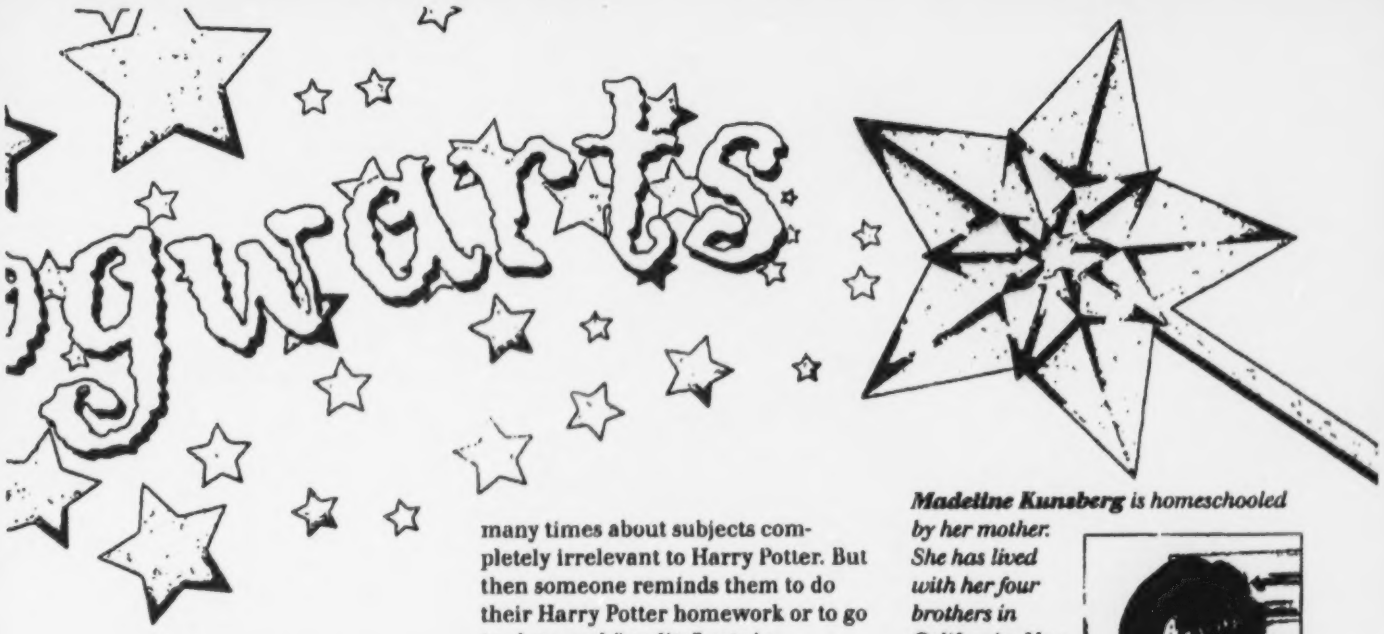

I decided to create the roles of bankers and shopkeepers—jobs that pay well in imaginary money. If we taught our members how to build their own Diagon Alley shops, we could link their sites to ours, creating smaller, family-owned shops. We no longer had to update and service a mail. When I posted the job offers on our main message board, the response was instantaneous and encouraging.

Business as Usual

Everything ran smoothly after that. Older teens and adults applied to be teachers of subjects like transfiguration, history of magic, flying class, and divination. Some of them even wrote books to use in their classes, such as *A Beginner's Guide to Transfiguration* and *A Guide to Chicken Gizzards*. Students came up with house cheering songs in an effort to foster house spirit, and a few e-mailed exemplary homework.

I got to role-play the part of Professor Snape, a bad guy who torments Harry. I enjoyed drilling students unmercifully on dangerous snakeskin potions like the Adnocana Potion (anaconda spelled backwards), and asking them to "predict what we will be studying next week."

Our members often spend time in the chat room, talking with friends—many times about subjects completely irrelevant to Harry Potter. But then someone reminds them to do their Harry Potter homework or to go to class, and "reality" sets in.

Through our role-playing site we provide the structure and opportunity for kids all around the world to establish relationships, but they take it from there. If you are considering creating your own, be prepared to take pride in your work, face obstacles, and have fun.

***Madeline Kunsberg** is homeschooled by her mother. She has lived with her four brothers in California, New Mexico, Switzerland, and New Jersey. You can reach her by e-mail at mkunsberg @home.com. Her site can be found at http://embarktohogwarts.tripod.com*

Let's Talk Specifics: Q&A with Madeline

What skills do you need to create a role-playing site?

Before creating a site, you should become knowledgeable about how the Internet works. Visit chat rooms, message boards, and other role-playing sites to get ideas. Learn how to copy images and code without violating any copyright laws. Practice HTML and experiment with different elements of layout and design. A good Web developer can also type, spell, and communicate well verbally. But most importantly, you have to be persistent. Don't ever give up!

How much time do you spend working on your site?

The time commitment and stress level would be equivalent to having a final exam every other week. It's just something you don't want to think about or else you won't get started.

Where did you get the graphics for your site?

We borrowed or created all of our graphics. As long as it's not copyrighted, you can copy and use any image on the Web. And if you want, you can alter the image in a graphics program such as Jasc Paint Shop or Adobe Photoshop. Owning a scanner and a digital camera is also helpful.

Did you have to get permission from J.K. Rowling to use the Harry Potter characters?

No, because we don't make money from our site and we don't detract business from Warner Brothers, who owns the movie and book rights.

Were there any Web sites that were especially helpful to you while creating your role-playing site?

Yes. I learned HTML at Webmonkey.com, which is a good resource for Web developers. Quidditch.com and Fandom.com both linked our site to theirs and helped us get the word out. And Tripod.com gave us 50 free megabytes of online space, which allowed us to put our site online.

How long did it take to complete your site?

We're not even close to being finished; in fact, we're just getting started.

—Michelle Burkhart

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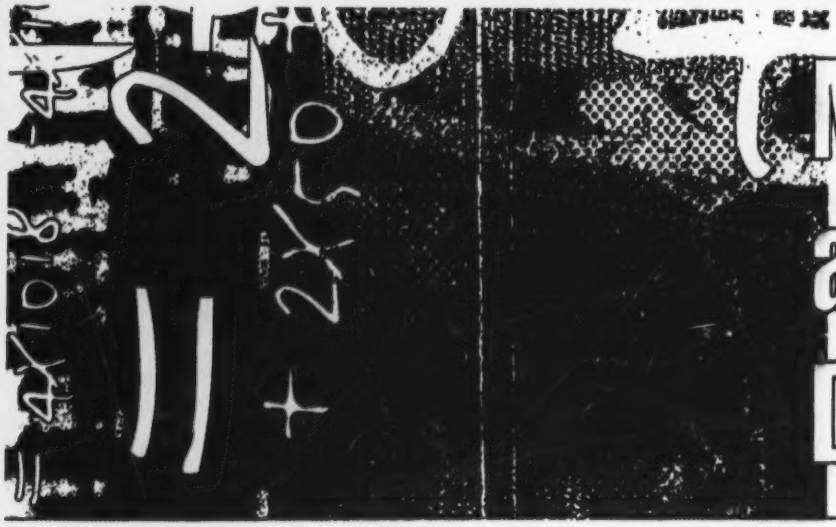

Math in Depth and From a Distance

by Philip White

When I was in third grade, I couldn't get enough of what I called "x-equals" problems, which are basically prealgebra equations. I relentlessly asked my parents to quiz me and also made up my own problems to try out on anyone who was around. I had an insatiable passion for math. So when my elementary school could no longer accommodate me mathematically, my mom searched for other options. After reading a newspaper article about distance learning programs, she knew she had the solution.

Math seemed like the ideal discipline for distance learning. Whereas class discussions may be integral to courses like history and English, answers in math are either right or wrong. Computers can perform the necessary administrative tasks just as well as a teacher can—but a lot faster. I eagerly signed up for Algebra I through CTY's Center for Distance Education.

How It Works

I listened to excellent lectures, which were accompanied by simulations of a teacher writing on a chalkboard, on a CD-ROM. The material was always accessible. If I was having trouble understanding a certain concept, I could go back and listen to the lecture as many times as I needed to. I worked on selected problems and entered my answers into the computer. At the end of each chapter, I took an exam. I loved being able to work on my own and at my own pace.

Although teachers and students are not engaged face-to-face, tutors really can make or break the distance learning experience. My first tutor was wonderful. She encouraged me through Algebra I and II, congratulated me on jobs well done, gently offered suggestions for improvement, and genuinely understood the intensity of my interest in math. In contrast, another tutor provided virtually no feedback throughout the entire course.

Taking a Break

By the time I reached Precalculus, I started to get tired of studying math; it just wasn't as exciting for me anymore. I would work for an hour or two and get bored. Although I would force myself to go on, I wouldn't work as quickly or as well. When I began doing poorly in Precalculus—getting C's and below when I had been getting mostly A's—I realized that I was burnt out and needed a break.

I quit the precalculus course early and decided to take some time off from distance learning. As a seventh grader at a combined middle and high school, I was placed in a precalculus class with juniors and seniors. At first, I worked ahead in the textbook when I thought the class's pace was too slow. But then I realized that no matter how quickly I worked on my own, I would only learn as much as the rest of the class would by the end of the year. So I slowed down to the class's pace and found myself wishing that I had just stuck with distance learning.

In a way, burning out was good for me because it made me realize that there are other subjects worthy of serious pursuit, like politics, history, computer programming, and Web design. I also became interested in sports, including tennis, ping-pong, volleyball, and archery. I had gotten so carried away with studying math that I hadn't allowed myself to enjoy many other interests.

My experience with distance learning was like trying to sprint the mile. I forced myself to keep running as fast as I could, but I just couldn't keep up the same pace. You have so much freedom in distance learning that it is easy to get carried away; you must set boundaries for yourself. I took this lesson to heart as I signed up for the distance learning course Calculus A.

Distance learning programs are an excellent opportunity for curious, motivated individuals. I would recommend distance learning to those who do well in a particular subject in school, but are bored by the class itself. Because of all the work and self-discipline required, an interest in the subject is absolutely essential.

Distance learning has allowed me to learn material quickly so that I can continue to learn more and more about a subject I love. It has allowed me to develop my strengths and to pursue my interests in greater depth than I ever could have hoped to do otherwise.

***Philip White** is a 14-year-old freshman at Thomas Jefferson High School for Science and Technology. His interests include reading, math, fencing, canoeing, and chess.*

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SELECTED DISTANCE LEARNING OPPORTUNITIES

CTY'S DISTANCE LEARNING PROGRAMS

CTY's Center for Distance Education offers flexible, self-paced courses in writing and mathematics that integrate sound pedagogy, solid curricula, and expert tutors.

The Math Tutorials

The Math Tutorials offer courses in mathematics for grades K-12. Courses range from Prealgebra to Linear Algebra and Multivariate Calculus. Students work at their own pace using CD-ROM software and consult regularly with their tutors online. Students must achieve qualifying scores on the math portion of the SCAT (Grades 2-4), PLUS (Grades 5 & 6), or SAT-I (Grades 7 & 8) to participate. K-1 students qualify based on recommendations and above-grade-level scores on a quantitative analysis or mathematical achievement test. New enrollments begin every month.

Center for Talented Youth, Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218; math.tutorials@jhu.edu; www.jhu.edu/gifted/math

The Writing Tutorials

The Writing Tutorials offer courses in writing for grades 6-12. The program offers five levels: The Process of Writing; Revisions for an Audience; Crafting the Essay; Writing Analysis and Persuasion; and Crafting Poetry, Crafting Fiction, and AP Composition. Each course—consisting of 12 lessons—is an exchange of letters and assignments via surface mail or e-mail. Students must achieve qualifying scores on the verbal portion of the SCAT, PLUS, or SAT-I to participate; some classes have prerequisites. Enrollments are in January, February, June, September, and October.

Center for Talented Youth, Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218; (410) 516-0231; gifted writing@jhu.edu; www.jhu.edu/gifted/writing

DISTANCE LEARNING PROGRAMS FOR CREDIT

CTD's LetterLinks

LetterLinks offers courses in mathematics, social sciences, and the humanities for grades 6-12. High school teachers experienced in teaching academically talented students work individually with each LetterLinks student on courses at honors and AP levels. Students receive and send course materials via surface mail or e-mail. Starting dates for LetterLinks courses are in the fall, winter, and summer. All courses run for nine months, but students can proceed at a faster pace. The next application deadline is May 15, 2001.

LetterLinks, Center for Talent Development, 617 Dartmouth Place, Evanston, IL 60208-4175; (847) 491-3782; ctd@nwu.edu; www.ctd.northwestern.edu/programs/ll

Indiana University's College Credits NOW

College Credits NOW from Indiana University's Independent Study Program allows high school students to take high school and college courses simultaneously. The curriculum includes introductory-level university courses in 26 academic areas, ranging from Astronomy and Geography to Philosophy and Political Science. Courses use textbooks and learning guides, as well as video- and audiotapes, CD-ROMs, computer software, and the Internet. Enrollments are offered year-round.

Indiana University, Office of Academic Programs, School of Continuing Studies, Owen Hall 002, 790 E. Kirkwood Avenue, Bloomington, IN 47405-7101; (800) 334-1011; scs@indiana.edu; http://scs.indiana.edu

Penn State Independent Learning Program

College-credit courses are available to gifted high school students who have completed 11th grade, have not yet graduated from high school, and earn qualifying scores on the PSAT or SAT. The Department of Distance Education monitors the student's progress, and an Independent Learning advisor is available. Students are encouraged to enroll early since approvals can take up to six weeks.

Department of Distance Education, The Pennsylvania State University, 207 Mitchell Building, University Park, PA 16802-3601; (800) 252-3592; psude@psu.edu; www.outreach.psu.edu/de

Texas Tech Extended Studies

Freshman- and sophomore-level Texas Tech University Extended Studies courses such as English, History, Government, Psychology, Economics, and Algebra II are offered through the dual credit program. With the approval of a high school principal or counselor (not necessary for homeschoolers), students can earn high school and college credit simultaneously. All courses are self-paced, self-directed, and take six months to complete. Students correspond with instructors via surface mail, e-mail, and fax. Enrollments are offered year-round.

Outreach and Extended Studies, Texas Tech University, Box 42191, Lubbock, TX 79409-2191; (800) 692-6877; distlearn@ttu.edu; www.dce.ttu.edu

University of Missouri-Columbia High School

The University of Missouri-Columbia High School's (MU High School) curriculum includes over 150 courses. Gifted courses in foreign languages, language arts, science, and radio are offered in addition to standard high school courses. Students who have completed the 11th grade and are in the top fourth of their class may also enroll in entry-level university courses. Some courses have prerequisites. Students have nine months to complete a course. Enrollments are offered year-round.

University of Missouri, Center for Distance and Independent Study, 136 Clark Hall, Columbia, MO 65211-4200; (800) 609-3727; cdis@missouri.edu; http://cdis.missouri.edu

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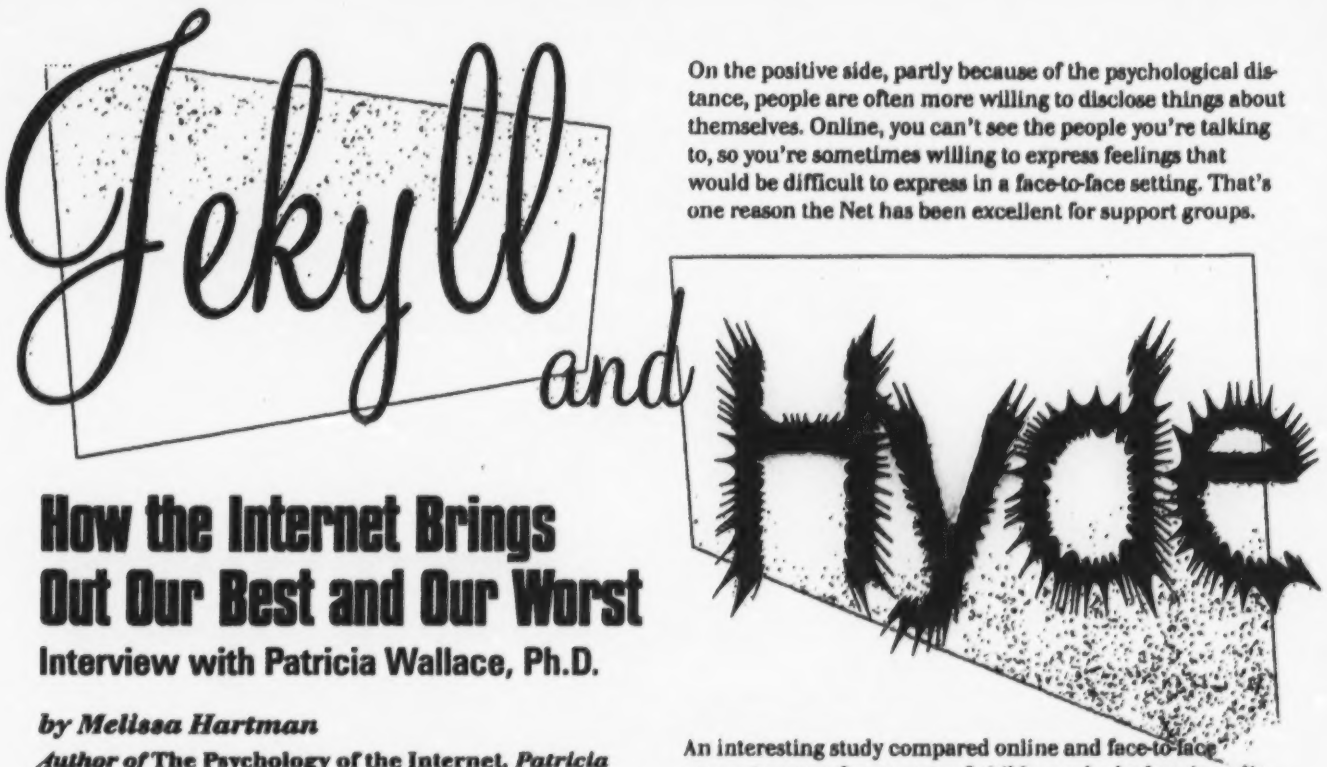

How the Internet Brings Out Our Best and Our Worst

Interview with Patricia Wallace, Ph.D.

by Melissa Hartman

Author of* The Psychology of the Internet, *Patricia Wallace holds an M.S. in computer systems management and a Ph.D. in psychology. Her expertise includes distance learning, information technology strategy, knowledge management, and the role of the Internet in education and society. She currently works for CTY as Director of Information Services and Instructional Technology.

What motivated you to write this book?
I have a background in both psychology and information technology, so I was intrigued by what I saw as a split in the reaction to the Internet. When the rush came in the mid '90s for everyone to get online, some people were saying it was the greatest technology ever, but many headlines were highlighting the dark side of the Net and the ghastly things that were happening out there. I wanted to draw on research in psychology, communications, education, and other fields to examine the Net's environment, and how it interacts with our behavior. It can have a very powerful effect, and can sometimes lead people to behave in surprising ways.

What is it about the Net that makes people behave differently?
The Net environment doesn't have many ways for people to use those critical nonverbal aspects of communication, such as facial expressions, tone of voice, laughter, or gestures. It increases psychological distance, offers the potential for anonymity, and also encourages impulsiveness. It's very easy, for example, to write a flame and click the send button without thinking about the consequences. Without the Net, if you wanted to express anger, you'd have to write a letter or make a phone call or see someone face-to-face, and that would give you opportunity to rethink and to reevaluate what you wanted to say.

On the positive side, partly because of the psychological distance, people are often more willing to disclose things about themselves. Online, you can't see the people you're talking to, so you're sometimes willing to express feelings that would be difficult to express in a face-to-face setting. That's one reason the Net has been excellent for support groups.

An interesting study compared online and face-to-face support groups for parents of children who had various disabilities. The online groups were much more active, and, interestingly, a lot more men participated in the online groups than in the face-to-face groups. The Net environment seems to make people feel freer to express their feelings and to both seek and give help, advice, and support.

With so many people to talk to and so many activities to participate in, is it possible for people to become addicted to the Internet?
I wouldn't call it an addictive disorder, but there are plenty of people who spend more time online than even they want to, especially in simultaneous, or synchronous, environments like games and chat rooms. Those have several components that keep people glued to the monitor, such as moving up levels or the rewards that come from positive social interactions and attention. A lot of people literally stay up all night and lose sleep to participate in these environments. It is becoming an important concern.

You mentioned the social rewards people receive online. Do the social skills people gain online translate into the real world?
Anecdotal evidence suggests that they do, particularly for people who are shy. People gain confidence when they interact successfully online. If shy people try to be more outgoing—offering suggestions or information or participating in a way that they wouldn't have done in person—and they get responses, they are likely to try doing those things in real life.

One very useful online environment for shy people is distance education classes. In regular classrooms, it's usually the extroverted, more confident students who will speak up and give answers or ask questions. There may be some extremely articulate and clever people who have something to

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contribute but who don't for any number of reasons—they're shy, they're afraid of social disapproval, they have an accent, they're afraid to ask a dumb question. Online, students have the chance to think through what they want to say, to edit it before they contribute it, and they can contribute it regardless of how many other people contribute. This gives shy students a chance to participate even if they don't have the confidence in person to jump into the fray with all the extroverts. When they start receiving positive responses, they will probably gain confidence that will stay with them in the real world.

Aside from experimenting with social skills, how else is an online persona important?

It's as important as our real-world persona in terms of how we want people to perceive us. In the real world, physical appearance, gender, and age usually dominate the first impression we make. Those factors influence what people think of us before we even open our mouths. Online we are freed from those limitations, both in terms of how others see us and how we see others. Online, we create a persona with words.

Because our words will influence how we are perceived, we have to be sensitive to what others will think when they read them. E-mail in particular is mostly informal. Students tend to treat it, especially with each other, as a way to joke around, a way to quickly send information. But when they start dealing with people outside the student world, like their teachers, their professors, or professionals in business or government, they often don't think about the impression they're making. For example, a friend of mine who is a professor from Armenia is appalled when students send him messages addressing him by his first name, all in lowercase with a smiley face at the end.

When people communicate face-to-face, most of their message is conveyed through nonverbal aspects of speech—gestures, facial expressions, inflection. The words are all that's conveyed in e-mail. People are often surprised that others misinterpret the intent or the tone of their message, but it happens all the time.

In your book, you say that as individuals we have the power to make the Internet a better place. How can we do that?

I think we have to rethink what it means to be ethical online. In this country, we have longstanding values that have served us reasonably well, such as protection of privacy and freedom of speech. The Net presents significant challenges to those values, partly because information in digital form is so easily collected, disseminated, and analyzed, and its original source may not always be easily identified.

For example, regarding privacy, what information should a business be allowed to collect about you, and how should they be allowed to use it? This varies depending on the circumstances, but some businesses have collected more than we expected without our knowledge or permission, and then have used the information in troubling ways. The forms people fill out to register products, download free software, enter contests, or complete surveys should be examined carefully.

We don't mutate into a new species when we connect to cyberspace, but the psychological factors that affect our behavior in real life play out differently online because the environments we enter are different. The more we know about these environments and their effects on all of us, the better chance we have to use our own contributions to shape them into something better.

— Patricia Wallace, *The Psychology of the Internet*

Intellectual property is another area in which the Net is raising new ethical issues. It is far easier to plagiarize, for example, with a simple cut-and-paste operation. It is also much more difficult to identify when people use sources from the Internet. The Napster case raised other issues about intellectual property. In the Internet Age, it is incredibly easy to distribute perfect digital copies of music without paying for them. The debates about this case are very heated, and people are struggling with what intellectual property really is in the digital age, how it should be protected, and how we can reward people for making artistic and intellectual contributions. We've been confronted with these issues so quickly that we haven't had a chance to think them through. And I'm concerned about that.

The Net creates special problems because many of the features that encourage ethical behavior in face-to-face settings are absent, or at least not very obvious. For example, people often begin thinking about the ethical side of an issue when they see people being hurt, or recognize the potential for it. On the Net, it's hard to appreciate how many people might be hurt by some action, such as releasing a virus as a prank. They might not care if Microsoft goes down for a day, but they can't see all those other people who lost homework, hours' worth of work spent on a project, or critical financial or health information. They can't see the harm, and I think we have to increase that awareness.

We all need to think about what it means to be in the Internet Age. We have to think about how we are behaving in cyberspace, and what we can do to make the Internet a fantastic and extremely useful place. The Internet is a technology still in its youth, and the millions of us who share the online world have the power and the responsibility to influence its development. Whether the direction it takes will be a positive one is up to us.

SELECTED WEB-RELATED RESOURCES

COMPETITIONS

The ArsDigita Prize
80 Prospect Street, Cambridge, MA 02139; (617) 386-4100; www.arsdigita.com/prize/
Web programmers age 18 and younger who have built and maintained useful, educational, and non-commercial sites may submit entries for The ArsDigita Prize. One individual will win $10,000, one team will win $10,000 (to be divided among team members), and first runners-up each receive $1,000. In addition, winners and runners-up receive server resources for future work, an all-expenses-paid trip to the computer science research laboratories at MIT, and a free Web publishing "boot camp" at ArsDigita Corporation. Entry deadline: May 15.

ISU American Government Web Contest
Iowa State University, Office of Admissions, Web Design Contest, 314 Alumni Hall, Ames, IA 50011; www.admissions.iastate.edu/contest/ha/homepage.html
High school juniors and seniors submit Web sites designed for teenagers and based on topics covered in honors or AP American government courses. Sites must include between five and ten original activities or pages and must not exceed five megabytes. One $20,000 scholarship and two $10,000 scholarships to Iowa State University are awarded. Entry deadline: February 1.

ThinkQuest Internet Challenge
Advanced Network & Services, Inc., 200 Business Park Drive, Armonk, NY 10504; (914) 765-1138; tq-help@advanced.org; www.thinkquest.org
Students 12–19 years old participate in this Web site design contest as members of a two- or three-person team. Team members don't have to be the same age, enrolled in the same school, or even citizens of the same country. Working with as many as three coaches, teams submit an entry in one of five categories: Arts & Literature, Science & Mathematics, Social Sciences, Sports & Health, and Interdisciplinary. Winning teams share scholarships and cash awards totaling over one million dollars. A similar program for students in grades 4–6, ThinkQuest Junior, awards a total of $250,000 in cash, computers, and networking resources to winning students, teachers, and their schools. Deadline: Proposals due by May 31; entries must be submitted by September 5.

BOOKS

Internet History & Culture

A Brief History of the Future: From Radio Days to Internet Years in a Lifetime by John Naughton (Overlook Press, 2000).

Cyberethics: Social & Moral Issues in the Computer Age by Robert M. Baird (editor) et al. (Prometheus Books, 2000).

How the Web was Born: The Story of the World Wide Web by Robert Cailliau and James Gillies (Oxford University Press, 2000).

Inventing the Internet by Janet Abbate (MIT Press, 1999).

Nerds 2.0.1: A Brief History of the Internet by Stephen Segaller (TV Books, Inc., 1999).

The Psychology of the Internet by Patricia Wallace (Oxford University Press, 1999). *See page 16 of this issue for an interview with the author.*

Virtual Addiction: Help for Netheads, Cyberfreaks, and Those Who Love Them by David N. Greenfield (New Harbinger Publications, 1999).

Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by Tim Berners-Lee with Mark Fischetti (Harperbusiness, 2000).

Web How-To

HTML 4 for Dummies by Deborah S. Ray and Eric J. Ray (Hungry Minds, Inc., 2000).
The "for Dummies" series also includes books on Web-related topics such as FrontPage, GoLive, and Dreamweaver.

HTML 4 for the World Wide Web Visual Quickstart Guide by Elizabeth Castro (Peachpit Press, 2000). *Visual QuickStart Guides are also available for Javascript, Perl and CGI, DHTML, XML, Dreamweaver, Flash, and more.*

Learning Web Design: A Beginner's Guide to HTML, Graphics, and Beyond by Jennifer Niederst and Richard Koman (O'Reilly & Associates, 2001).

Teach Yourself Web Publishing with HTML and XHTML in 21 Days by Laura Lemay (Sams, 2001).
Once you have some Web publishing skills, you might want to check out the many other Sams teach-yourself books, including those for Flash, Dreamweaver, ColdFusion, and GoLive.

Web Style Guide: Basic Design Principles for Creating Web Sites by Patrick J. Lynch and Sarah Horton (Yale University Press, 1999).

WEB SITES

Online Publications

Web Developer
www.webdeveloper.com
Written for Web professionals, this

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online magazine offers tips, how-to articles, free downloads, and product reviews that would appeal to anyone interested in maintaining and improving a Web site.

Web Developer's Journal
www.webdevelopersjournal.com
Whether you're just getting started or have plenty of Web publishing experience, you'll find useful advice and tutorials to sharpen your skills.

Wired Magazine & Wired News
www.wired.com

What's new in the e-world? Check out this site for the latest in online business, culture, technology, and politics, and link to the latest issue of the online version of *Wired* magazine.

ZDNet Developer
www.zdnet.com/devhead/
From the publisher of *PC Magazine*, *Developer* offers news, tips, discussion forums, and a free update e-newsletter for experienced Web programmers.

Web Publishing Guides

ABCs of Building a Web Site
www.webdevelopersjournal.com/columns/abcs_of_building_web_sites.html
A friendly introduction to Web publishing, this site offers helpful instruction as well as links to many free downloads and references that will be helpful to the beginner.

Learn the Net: Build a Web Site
www.learnthenet.com/english/section/webpubl.html
Written for business professionals, this site has loads of relevant material for anyone just getting started with Web publishing.

WEB Alley: Web Publishing Made Easy
www.weballey.net
With everything from history to HTML tutorials to many, many resources for Web designers, this is a great site for both beginners and those looking to improve existing sites.

Webmonkey
www.webmonkey.com
If you've never published a Web page, this is a great place to start. And if you have, you'll still find the software reviews and quick reference guide useful. Younger students might enjoy Webmonkey for Kids, which you can link to from this site.

WEB RESEARCH TOOLS

For easy access to all of these links, visit *Imagine's* Web site: www.jhu.edu/gifted/imagine/links_85.htm

Web Search Guides & Tutorials
Many, many more tutorials exist on the Web. These are three of the best:

Bare Bones 101: A Basic Tutorial on Searching the Web
www.sc.edu/beaufort/library/bones.html

Finding Information on the Internet: A Tutorial
www.lib.berkeley.edu/TeachingLib/Guides/Internet/FindInfo.html

Guide to Effective Searching of the Internet
www.completeplanet.com/Tutorials/Search/index.asp

Recommended Search Engines
You might have a favorite search engine, but try some of these if you haven't already. You'll be surprised at the differences.
Alta Vista: *www.altavista.com*
Fast Search: *www.alltheweb.com*
Google: *www.google.com*
Northern Light: *www.northernlight.com*

Search Engine Guides
Search Engine Report: *www.searchenginewatch.com/sereport*
SearchAbility: *www.searchability.com*

Recommended Metasearchers
Dogpile: *www.dogpile.com*
Ixquick: *www.ixquick.com*
MetaCrawler: *www.metacrawler.com*
SurfWax: *www.surfwax.com*

Recommended Library Gateways
Academic Info: *www.academicinfo.net*
Alpha Search: *www.calvin.edu/library/searreso/internet/as/*
Argus Clearinghouse: *www.clearinghouse.net*
Digital Librarian: *www.digital-librarian.com*
Infomine: *http://infomine.ucr.edu*
The Internet Public Library: *www.ipl.org*
Librarians' Index to the Internet: *http://lii.org*
PINAKES: *www.hw.ac.uk/libWWW/irn/pinakes/pinakes.html*
The WWW Virtual Library: *http://vlib.org/*

Recommended for Searching the Invisible Web
CompletePlanet: *www.completeplanet.com*
direct search: *http://gwis2.circ.gwu.edu/~gprice/direct.htm*
InvisibleWeb: *www.invisibleweb.com*
Price's List of Lists: *http://gwis2.circ.gwu.edu/~gprice/listof.htm*
ProFusion: *www.profusion.com*

Online Libraries
Library of Congress: *www.loc.gov*
LibWeb: *http://sunsite.berkeley.edu/Libweb/*
New York Public Library: *www.nypl.org*

Online Texts
Humanities Text Initiative: *www.hti.umich.edu/*
Project Bartleby: *www.bartleby.com*
Project Gutenberg: *www.gutenberg.net*
Schoenberg Center for Electronic Text & Images: *www.library.upenn.edu/etext/*
The Complete Works of William Shakespeare: *http://tech-two.mit.edu/Shakespeare/works.html*

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STUDYING CURRENT AT THE QUANTUM LEVEL

by Carol Blackburn

A year ago, Mariangela Lisanti had barely heard of conductance quantization, a phenomenon central to the young field of nanotechnology. Today, she has revolutionized the way it is measured. For her ingenuity and achievement, this Westport, Connecticut, high school senior won first place in *both* the Intel Science Talent Search (STS) and the Siemens Westinghouse Science & Technology Competition.

"I wasn't planning to design a new apparatus. I was just trying to understand what happens when electrical current moves through a nanowire," Mariangela explained. "In a nanowire—one that is just a few atoms wide—electrical conductance is quantized, meaning that it moves in discrete packets or quanta rather than in a continuous stream. Before we can build nanocircuits, we need to study conductance quantization and to look at the phenomenon in a variety of metals because different metals have different electrical properties at the atomic level. *That* was what I was planning to study for my STS project."

Last summer, when Mariangela began working in the laboratory of Yale University electrical engineering professor Mark Reed, the method used to measure conductance in nanowires was expensive and slow—not the sort of procedure a student could repeatedly run just to get a feel for what was going on, which is what Mariangela wanted to do. To give herself that freedom, Reed suggested she build a simple setup: a circuit with two fine gold wires that barely touched, hooked up to an oscilloscope. "When I banged on the table," Mariangela recalls, "I could detect conductance quantization just as the wires moved out of contact with each other. For a fraction of a second, the contact was just a few atoms. The fact that I was getting data for something that was occurring on the level of electrons and atoms amazed and excited me. But as I sat there,

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pounding away, I thought, "There has *got* to be a much better way of doing this.'"

She experimented with attaching one of the fine wires to an audio speaker and using sound to cause the wires to vibrate in and out of contact. Over the next few months, she refined her apparatus and compared its accuracy with that of the machine currently in use. Not only was her $35 creation as accurate as the $100,000 standard; it was *much* faster, collecting a thousand times more data in an hour than the standard equipment. With it, she has recorded higher-order quantum conductance values never before observed with the slower machine.

"Professor Reed gave me a great deal of freedom to figure things out," she recalls. "It was an amazing experience to learn what the scientific process really is. When you're doing something that has never been done before, it's a process of trial and error. What really pulls you through is hard work. I think of it as a probability function: the likelihood that you are going to find a solution to your problem increases as a function of the amount of time you put into it."

Providing a place to try out ideas—to *experiment*, not just to do experiments—was one of Reed's goals as a mentor. "It is important to create an environment where a student has the freedom to fail as well as to succeed, one that fosters critical thinking and creativity," he said. "I think Mariangela actually learned more from the failures than the successes."

With the excitement of the science competitions behind her, Mariangela can finally get back to her research. "Now that I've developed this apparatus, I'm going to use it to compare the conductance quantization of different metals." That is, until she finds herself frustrated by another piece of equipment, and inspired to innovate again.

Photo courtesy of Intel Corp.

INTEL SCIENCE TALENT SEARCH (STS)

Now in its 60th year, the STS offers public recognition and college scholarships to the 40 contestants chosen as finalists. First-, second-, and third-place winners receive $100,000, $75,000, and $50,000, respectively. Fourth- through sixth-place winners receive $25,000 each. Seventh- through tenth-place winners receive $20,000 each. The remaining 30 finalists each receive $5,000 scholarships. Each finalist also receives a laptop computer with a Pentium® III processor.

This year's top STS winners were:

1. **Mariangela Lisanti**, 17, of Westport, CT.
2. **Nathaniel Craig**, 18, of Sacramento, CA.
3. **Gabriel Carroll**, 18, of Oakland, CA.
4. **Alan Dunn**, 17, of Potomac, MD.
5. **Michael Hasper**, 18, of Tallahassee, FL.
6. **Vinod Nambudiri**, 17, of Rye Brook, NY.
7. **Johanna Waldman**, 17, of Roslyn, NY.
8. **Hans Lee**, 18, of Carmel, CA.
9. **Robert Horch**, 18, of Weatherford, TX.
10. **David Khalil**, 18, of Great Neck, NY.

For more about the Intel STS and this year's finalists, see www.sciserv.org/sts/

SIEMENS WESTINGHOUSE SCIENCE & TECHNOLOGY COMPETITION (SWSTC)

In its second year, the SWSTC also awards college scholarships to high school seniors, recognizing both individual and team efforts in science and technology. The top individual receives $100,000 and the winning team shares $100,000. Five individuals and five teams are named as runners-up and are each awarded $20,000, with the teams dividing their awards.

This year's top SWSTC winners were:

Individual: **Mariangela Lisanti**, of Westport, CT.

Team: **Christopher Clearfield, Charles Olbert, and Nikolas Williams** of the North Carolina School of Science & Mathematics, in Durham, NC.

For more about the Siemens Westinghouse Competition, see www.siemens-foundation.org

The Art and Sport of Ballroom Dance

by Meg Pedrick

Since the 1920s, competitive ballroom dance has lured dancers to the floor. In 1997, the International Olympic Committee recognized ballroom dance, now called DanceSport, as a sport; in the 2008 Summer Olympics, dancers may be competing for medals. Today, you'll find competitive dance teams on many college campuses, and you'll see several pairs competing even in the Nine Years and Below division in contests across the country. As the sport continues to gain popularity among teens and preteens, you might even find yourself transformed—as 15-year-old Meg Pedrick did—from spectator to serious competitor.

Dance till the stars come down from the rafters;
Dance, dance, dance till you drop.

—W. H. Auden

As a young girl, I danced to Frank Sinatra on my dad's feet. Eventually, I learned that we had been dancing the waltz's basic box pattern. My father taught me all the basic social dances when I was little, but it wasn't a serious interest for me until one night when I was nine years old.

My parents, both avid dancers, were planning to attend a dance that night, but they couldn't find a babysitter for me. They decided to bring me along. For most of the night I sat in a corner reading a book, completely uninterested in the dancing going on around me. My father, however, insisted that I do one waltz with him. I grudgingly joined him on the floor. Maybe it was the music, or maybe it was the thrill of dancing on a full dance floor for the first time, but as we whirled around the room, I felt incredible elation. After that night, I became an avid social dancer myself, attending every dance my parents allowed me to.

The Fantasy Comes Alive

A few years later, my parents became interested in competitive dance. They started taking lessons with Bobbi Davies, the only ballroom coach in the area who taught competitive dancing, which she called International Style. We had watched International Ballroom Dancing on PBS, intrigued by the feathery ballroom dresses and skimpy Latin costumes, and wondered what those competitions were really like. On TV it seemed so unreal, a fantasy world where men wore only black tail suits and the women beautiful gowns.

After my parents had taken many lessons, I went with them to their first competition. As soon as I walked

through the doors, the fantasy world I had seen on TV came alive. Everywhere I looked, I saw women with heavy makeup and vivid outfits and men wearing formal tail suits. The ballroom was a huge gymnasium with a portable wooden floor in the center. Weaving our way through all the proud looking dancers, we eventually found our table. I sat at the very front, closest to the dance floor.

Five hours passed in the form of waltzes and tangos, cha-chas and sambas. The swirling ball gowns, beautiful music, and rhythmic movements held me hypnotized. Thinking I was bored, my parents kept suggesting that I go take a walk with them. I refused each time, not wanting to miss even a single second.

I soon began to notice that people my own age were dancing as well as the adults, and some even better. The number of young people competing surprised me; somehow I had thought that this was a sport open only to adults. But now I could almost see myself out there in ball gown and makeup. I wanted to compete.

It Takes Two

Knowing that dance lessons can be expensive, I spent the next few months working up the courage to ask my parents for them. When I finally asked if I could have them for my 13th birthday, they made a deal with me: They would pay for one lesson a week and entry fees to competitions. I pay for the two or three additional lessons that I take each week by babysitting and working during school breaks.

Soon after I became one of Bobbi's students, I was eager to begin competing. Fortunately, Bobbi already had a partner for me: her only other young student, Joe Larose.

When we first met, I was in seventh grade and Joe was a sophomore in high school. Despite the age difference, Joe and I are a perfect match physically: our waists are at the same height, which is a great advantage in dancing. But the real strength of our partnership is communication. When we first started dancing together, we were both very shy, and we didn't feel secure enough to talk about what might improve the other person's dancing. Now, two years later, we have gotten to a point where we can comfortably give and take suggestions for improvement. We have come to realize that we can become better dancers—individually and as a pair—if we listen to each other.

The Floor is Ours

Just one month after Joe and I started dancing together, we entered our first competition. I didn't realize how much more there was to it than what I'd seen at my parents' competitions. First, we had to decipher the schedule of events. All the rounds, or heats, are listed in the order they will be danced with times next to each one. However, if there aren't many dancers in each heat, two heats might dance at the same time. This sometimes puts the schedule ahead of time. (Once, Joe and I didn't realize that the schedule was running ahead until after we were supposed to be on the floor. We had to run onto the floor in the middle of the waltz. I don't remember how we placed, but we've definitely been more attentive to the schedule since then.)

After figuring out our schedule, it was time to change into tails and ball gown. I can now change, put on makeup, and twist my hair into a bun in about 15 minutes, but at our first competition I spent nearly two hours getting ready. After we were dressed and warmed up, all we could do was wait to dance. I wasn't nervous, though. I was almost relieved: I had wanted to compete for so long, and now I was ready to take the floor.

There were no other couples in our category, so we would be dancing alone. Still, I felt oddly calm. Joe led me onto the floor, and still no butterflies. As the music began, Joe raised his arm—the signal for me to approach him and come into dance hold. The lilting foxtrot music filled my ears. I counted out the introduction and then, almost as if we could read each other's minds, we started across the

floor. I concentrated so hard on what my feet were doing that I almost forgot to pay attention to Joe's lead.

In this first competition, we danced in the two lowest categories, Novice and Preliminary*. We danced well in the Preliminary category, which is the higher of the two. But after we danced in Novice, we were informed that we had been disqualified. Joe had danced in Novice a few years earlier with a different partner, and the rule, which has since been changed, was that you could dance in Novice only once. Bobbi thought that our situation would be different because I was a new competitor, but that wasn't the case. Although disappointed, we left the competition more experienced and more determined than when we arrived.

Dancing Our Way to the Top

Last spring, after dancing in more than 30 competitions together, Joe and I skipped several levels and began competing at the Championship level, the top category with the stiffest competition. To be competitive, we had to increase the complexity and difficulty of our routines. The timing in all of our dances had been strictly regulated; now we needed long, graceful figures to add depth to our foxtrot, and faster spins to add dimension to our waltz. We've always had to know our steps by heart and to be able to modify the figures to move around as many as 12 other couples on the floor at a moment's notice. But now the steps were harder to memorize and modify.

Joe and I spent hours and hours learning our new routines. Bobbi gave us a crash course in Open International Dancing, but we still didn't feel as prepared as we would have liked. Even my dress, which my mother had been working on for a month, was ready only the night before I had to wear it.

As we waited with all the top dancers on the edge of the floor, for the first time since we started competing, I felt very nervous. When we finally heard our number called, I gripped Joe's hand and we walked onto the floor. Unlike in our first competition, we were surrounded by couples. As the music began, Joe raised his arm and we took hold. We both felt timid among the more experienced dancers, but we maneuvered around them well. A few times I got lost, but we never had to stop dancing and start over. When we left the floor, I felt that we had danced well for our first time, but we both knew that we had a lot more work ahead of us. As always, we left the competition inspired and motivated.

Meg brushes the suede soles of her dance shoes to keep them wax-free.

I hope that Joe and I will be dancing together for a long time. Depending on where we go to college, we might have to commute in order to practice and take lessons together. But we both love to dance and compete, so it will be worth it. We hope someday to win the nationals, and when DanceSport becomes an Olympic sport, we would love to compete at that level. We may even decide to go professional at some point. But for now, we'll keep working and practicing. For now, we will just dance.

***Meg Pedrick** is a sophomore at Northfield High School in Vermont. Ranked 11th in the country in the Youth Standard Division in 2000, she and Joe are now preparing for the Blackpool Festival in England, the most prestigious ballroom dance competition in the world. They also hope to compete at the 2001 U.S. National Championships in Salt Lake City, UT, this August. You can read more about Meg and Joe at www.vermontdancesport.org*

*Meg and Joe's first competition was in Canada. These category names reflect the Canadian rules of the time and have since been changed.

Related Web Sites

DanceScape
www.dancescape.com

International DanceSport Federation
www.udsf.net

U.S. Amateur Ballroom Dance Association
www.usabda.org/usdsc/

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SELECTED DISTANCE LEARNING OPPORTUNITIES

continued from page 15

University of Nebraska-Lincoln Independent Study High School
The University of Nebraska-Lincoln Independent Study High School (ISHS) offers Internet courses via its CLASS program—Communications, Learning, and Assessment in a Student-centered System. The curriculum includes courses in 20 academic areas. Advanced courses are available for accelerated students. Students correspond with instructors via telephone, surface mail, fax, and e-mail. Students have 12 months to complete a course. Enrollments are offered year-round.

University of Nebraska-Lincoln, Independent Study High School, P.O. Box 839801, Lincoln, NE 68583-9801; (877) 243-4747; unlishs@unlnotes.unl.edu; www.unl.edu/ishs

University of Wisconsin-Extension
The University of Wisconsin-Extension offers over 500 university, high school, vocational, and continuing education courses. Qualified high school students may take university courses for university credit. Most courses rely on surface and air mail, but most instructors accept faxes and e-mails. Students have 12 months to complete a course. Enrollments are offered year-round.

University of Wisconsin-Extension, Independent Learning, 505 South Rosa Road, Suite 200, Madison, WI 53719-1257; (800) 442-6460; info@learn.uwsa.edu; http://learn.wisconsin.edu

Virtual High School
The Virtual High School (VHS) is a cooperative of more than 150 high schools across the U.S. that offers NetCourses taught by teachers for students in the cooperative. Each school contributes teachers who design and offer Internet courses. NetCourses range from advanced academic courses to technical and specialized courses. The curriculum includes more than 150 courses, ranging from Environmental Chemistry to Intermediate Accounting and Entrepreneurship. VHS courses are taught for either one semester or one year. Students work at their own pace. Schools in the cooperative award credits. Enrollments are offered year-round.

Virtual High School, 60 Thoreau Street PMB 363, Concord, MA 01742; (978) 369-4367; http://vhs.concord.org

DISTANCE LEARNING PROGRAMS FOR ENRICHMENT

Apex Learning's Online AP Courses
AP courses, taught by Apex Learning teachers, are organized through a virtual homeroom and CD-ROM. Practice exams and quizzes are modeled after the actual AP exam. The courses are designed for students ages 15-18. Courses last four or eight months. Your school may accept Apex Learning credits. Enrollments are in January, February, August, and September.

Apex Learning, 110-110 Avenue, NE, Suite 210, Bellevue, WA 98004; (800) 453-1454; inquiries@apexlearning.com; www.apexlearning.com

Gelfand Correspondence Program in Mathematics
The Gelfand Correspondence Program in Mathematics (GCPM) is for students ages 13-17. The program is based at Rutgers University, directed by Professors Robert Wilson and Israel Gelfand, a world-renowned mathematician. After enrollment you receive three books: *Method of Coordinates, Functions and Graphs,* and *Algebra.* (Two additional books, *Trigonometry* and *Geometry,* are in preparation.) About once a month, students receive assignments with problems and explanations. Students mail solutions to GCPM mentors, who respond with individual comments and suggestions. Material is organized in three levels, each of which takes about a year to complete. Students may apply year-round.

Gelfand Correspondence Program in Mathematics, Department of Mathematics, Rutgers University, Piscataway, NJ 08855-8019; (732) 445-3491; gcpm@math.rutgers.edu; http://gcpm.rutgers.edu

***Merlyn's Pen* Mentors in Writing Program**
The *Merlyn's Pen* Mentors in Writing Program is designed for students in grades 6-12 who want to learn to write better fiction, poetry, or nonfiction. Students are matched with published writers and editors from the *Merlyn's Pen* staff for personalized, one-on-one writing tutorials. Students work at their own pace. Eight writing assignments are sent—approximately every ten days (in the three-month program) or every three weeks (in the six-month program)—via surface mail or e-mail.

Merlyn's Pen Mentors in Writing Program, P.O. Box 910, East Greenwich, RI 02818; (800) 247-2027; merlynspen@aol.com; www.merlynspen.com

Quantum Ed
Quantum Ed offers individualized courses such as Physics, Chemistry, Biology, Earth and Space Sciences, and Algebra I and II. Courses represent approximately 180 hours of student work and are adapted to students' preferred learning styles, interests, and skill levels. Students work at their own pace. Your school may accept Quantum Ed credits. Any age may enroll year-round.

Quantum Ed, 1410 North Crain Highway, Suites 1B-9B, Glen Burnie, MD 21061; (800) 203-2471; www.quantumed.com

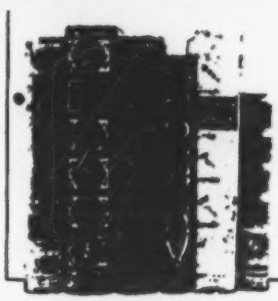
Virtual School for the Gifted
The Virtual School for the Gifted (VSG) offers courses such as Java Programming, Fantasy Writer, and Magic and Illusion. All courses are taught for nine weeks, operating solely over the Internet using e-mail, mailing lists, and newsgroups. There are no age requirements or qualifying exams. Enrollments are in February, April, July, and October. Please note that this school is based in Australia.

Virtual School for the Gifted, P.O. Box 549, Hurstbridge, Victoria 3099, Australia; +61 3 9710 1592; vsg-admin@vsg.edu.au; www.vsg.edu.au

SELECTED RESOURCES

Peterson's Guide to Distance Learning Programs 2001

Distance Learning Resource Network
www.dlrn.org/K12



Off The Shelf

by Rena Xu

Harry Potter and the Goblet of Fire

by J. K. Rowling

There's something magical about Harry Potter. So magical that the series devoted to the exploits of a young wizard has sold millions of copies worldwide and enthralled children and adults alike. While amusing and suspenseful plots intrigue younger fans, older audiences appreciate and relate to the psychological overtones and Harry's courageous battle to overcome obstacles. We sought the perspective of a gifted high school student to explain this phenomenon that has attracted millions of readers of all ages and taken them on an unforgettable journey into the magical world of Harry Potter.

Harry Potter is not an average 14-year-old boy, not even by wizarding standards. He has the usual adolescent concerns—friends, teachers, grades, and girls. But unlike other students at Hogwarts School of Witchcraft and Wizardry, Harry has to deal with more troublesome complications as well.

As an infant, he was the only wizard to survive the curse of Lord Voldemort, a powerful Dark Lord who mercilessly tore apart families and killed masses of wizards. But Voldemort failed to kill Harry, instead stripping himself of his terrifying destructive capabilities:

You all know that on the night I lost my powers and my body, I tried to kill him. His mother died in the attempt to save him—and unwittingly provided him with a protection I admit I had not foreseen ... My curse was deflected by the woman's foolish sacrifice, and it rebounded upon myself. Aaah ... pain beyond pain, my friends; nothing could have prepared me for it.

Voldemort makes numerous attempts to destroy Harry and reclaim his lost power, but time and again, Harry manages to slip through the icy grasp of the sickly and desperate Dark Lord.

The confrontation with Voldemort leaves Harry with a conspicuous scar on his forehead and a prominent identity in the wizard community. While the fame and attention are sometimes enjoyable, Harry longs to be just an average boy—to blend inconspicuously in the student body, free from the constant feeling of being watched and appraised. Which is why Harry is not too pleased to be chosen to participate in the Triwizard Tournament, a competition between three wizard schools—Hogwarts, Beauxbatons, and Durmstrang.

Students ages 17 and older (there is an age limit because of the high death rate among past competitors) may enter their names in the Goblet of Fire, which picks the worthiest student from each school. As the competitors' names are chosen and announced, the goblet does something quite unexpected. It selects a fourth contestant: Harry Potter. Fourteen-year-old Harry, who hasn't even been in school long enough to learn all the spells he will need in order to stay alive during the competition. Harry, who didn't even submit his name in the first place. Readers are left wondering: Who really entered his name in the goblet?

Because of the magical binding contract of the goblet, however, there is no turning back. Everyone thinks Harry entered illegitimately in a craving for attention. His best friend Ron, always cast in Harry's shadow, refuses to speak to him. Cedric, the other competitor from Hogwarts, and his supporters believe that Harry stole their glory and act cold towards him. Even Harry's pet owl refuses to acknowledge him as a friend.

The tasks he must complete only add to Harry's problems. Harry finds himself fighting dragons and gargantuan spiders, searching for mermaids, and outwitting sphinxes. But as he overcomes each obstacle, prospects seem to brighten and Harry surprises everyone with his exemplary performances. Just when it looks like Harry will be named Triwizard Champion, a drastic turn of events alters everything and leaves Harry forever changed.

As she did in the first three books of her Harry Potter series, J. K. Rowling carefully crafts yet another intricate, intriguing plot of adventure and mystery. Unlike the first three, however, *The Goblet of Fire* also contains an element of gravity as Harry realizes that the Dark Lord has regained power:

The thin man stepped out of the cauldron, staring at Harry ... and Harry stared back into the face that had haunted his nightmares for three years. Whiter than a skull, with wide, livid scarlet eyes and a nose that was flat as a snake's with slits for nostrils ... Lord Voldemort had risen again.

Rowling does an exceptional job of building each book in the series upon previous ones and planting preparatory exposition. For example, even though the reader learns in the first book that Harry's and Voldemort's wands contain feathers from the same phoenix's tail, the significance of this is not understood until the fourth book. By building upon previous stories, Rowling creates a continuous plotline that effectively shows Harry's progression as a student at Hogwarts. In *The Goblet of Fire*, the reader senses Harry's maturation and realizes his limitations; even Harry Potter does not always enjoy happy endings.

***Rena Xu** is a sophomore at North Allegheny in Pittsburgh, PA. She is the editor of her school's literary magazine and a member of the debate team. She enjoys playing the piano and has performed three times in New York City's Carnegie Hall, and once at the UN headquarters.*

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Word Wise: Networds

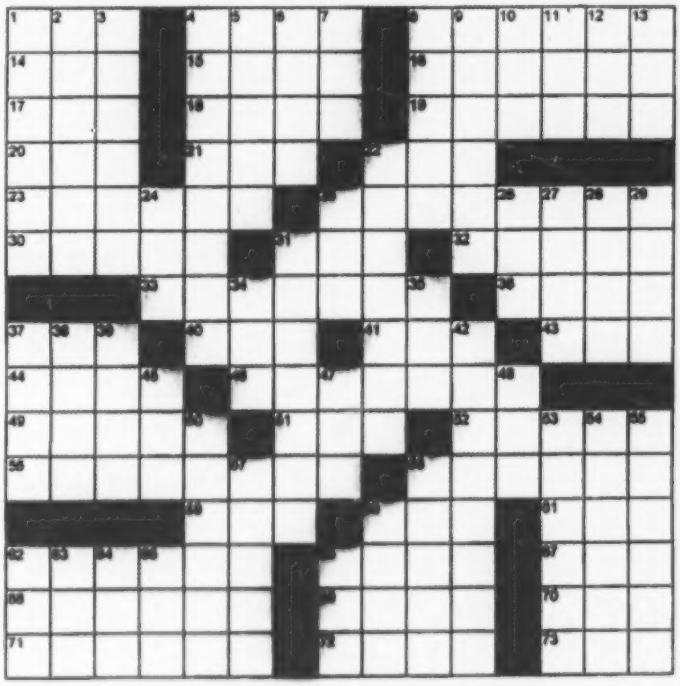
by Carol Blackburn

ACROSS

1 Day before Tue.
4 Junk e-mail
8 Small application which can be embedded in an HTML document
14 Poem
15 Post
16 Discard
17 Fixed
18 Ins and __
19 Discern
20 Sign language (abbr.)
21 "His Master's Voice" company
22 Sea, to Debussy
23 Old Testament prophet
25 Electronic boundary that prevents unauthorized users from accessing files
30 Captive
31 Article of clothing
32 Deteriorate
33 Secret codes
36 Lip
37 Disk operating system
40 Scoundrel
41 Active Server Page file name extension
43 Before
44 End-__
46 With 11 Down, inventor of the Web
49 Catch some Zs
51 Ma Bell
52 Starts an application
56 Linux creator
58 Former Soviet leader
59 Telephone Access System (abbr.)
60 Pair
61 Honest __
62 Fast Web walker
66 Fashionable
67 To be announced (abbr.)
68 Not a virus, but a program that reproduces every time it is opened
69 Air (prefix)
70 Deer relative
71 Long, slender fish
72 PC manufacturer
73 Ottoman Empire official

DOWN

1 The first widely used graphical Web browser
2 Black Sea port
3 A temporary loss of contact by a server, caused by network delays
4 Episodic
5 Diplomatic case
6 __ Vista
7 My (Fr.)
8 Lowly computer?
9 Looked at carefully
10 Plotter drawing file name extension
11 See 46 Across
12 And so forth
13 Vietnamese New Year
22 Mobile worker
24 Org. that sets international standards for the electronics field (abbr.)
25 Enemy
26 Network
27 Land measurement
28 Nest
29 Tick-borne disease
31 Topics of conversation on an electronic bulletin board
34 Ventura Publisher file name extension
35 Compass point
37 Electronic devices attract this
38 Capital of Norway
39 Oracle
42 The P in HTTP
45 Pastor (abbr.)
47 Request to send (abbr.)
48 Health resort
50 Provincial speech
53 Delighted
54 Half a byte
55 Devious
57 Java with milk
58 Twist around
60 Biblical "you"
62 Beginning of many URLs
63 __drum
64 Balanced budget amendment (abbr.)
65 Be back soon, in netspeak
66 Computer-aided design software



Solution on page 30

EXPLORING CAREER OPTIONS

Child Psychology

Interview with Karen Loftus, Ph.D.

by Carol Blackburn

A clinical psychologist and an adjunct clinical faculty member at the University of Virginia, Karen Loftus helps children, adolescents, and clinical psychology graduate students become more self-aware. In this interview, she talks about the challenges and rewards of her work, which takes her to both painful and resilient places in the human heart.

When did you become interested in psychology?

I was already drawn to work with children with special needs when I was in high school. At that time, I volunteered in a state hospital for severely retarded children. In college, I majored in special education, but as time went on, I decided that I didn't want to teach but still wanted to work with children who had problems. So I decided to get a master's degree in school psychology, then spent two years working as a school psychologist, evaluating students who were having difficulty in school, both academically and behaviorally.

How did you shift from school psychology to clinical psychology?

I spent the next three years working in clinical settings, at an outpatient psychological practice and at the adolescent unit of a private psychiatric hospital. In both settings, I was exposed to the clinical side of psychology—how diagnoses are made, how personality and family dynamics come into play, how psychotherapy works—and I became really interested in it. I decided to pursue a doctorate in clinical psychology, which I did at the University of Virginia. I then did a general clinical internship and a post-doctoral fellowship in clinical child psychology at Dartmouth Medical School. So while I always wanted to work with children with problems, my focus evolved as I got more experience and exposure to the field of psychology.

There are clearly lots of careers within the clinical world. Do you think a person needs to try out various roles in order to find where she is most comfortable?

That was certainly my experience. I didn't really know what was out there, and it took some time for me to become aware of the kinds of positions available and to find out what would be a good fit for me. In fact, even after I finished my post-doctoral training, I was still working it out. My first job was as a consultant at a pediatric hospital, working with children who were hospitalized for a variety of physical ailments. I was often called in when there was a question as to whether a physical problem might have an underlying psychological cause, for example, in the case of a child with gastroenterological problems for which no physical cause could be found. I would typically interview the child and parents, go over medical records, maybe do testing. With time, I realized that even though the work was interesting, it wasn't right for me. I didn't get to do as much therapy as I thought I would be doing, and the therapy I did was short term in nature. The experience confirmed that I preferred to work with children on a longer-term basis, to have the opportunity

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to establish a relationship and make lasting changes. So even at that stage in my training, I was still trying things out and learning what suited me best. I later took a job in a community mental health center where I could see people for both short- and long-term therapy, and that was a better fit for me.

What do you like best about your work?
I really enjoy the process of therapy. I like developing a relationship with my clients, coming to understand what might be driving their behavior, and then helping them to understand that—seeing them "get it." It is a great feeling to see kids come into their own and become happier and more effective.

While my specialty is working with children, I also work with adolescents, who are at an age and developmental stage I really enjoy. Adolescents are often bursting with energy and ideas and creativity, but they're also struggling with big maturational issues as they transition from childhood to adulthood. And they can get themselves into so much more trouble than children can! As a therapist, I try to balance my respect for their privacy and desire to be independent with my responsibility to watch out for when they may be engaging in self-injurious or dangerous behavior. I am very mindful of keeping a client's confidentiality and trust while also working to keep him or her safe. It's a fine line to walk. Working with adolescents can be challenging, but seeing them start to emerge into their own, making a good start on their lives, is very rewarding.

A psychologist-in-training must choose not only what kinds of patients she wants to work with, but also which therapeutic approach she wants to use. Can you talk about that?
Yes, that is a fundamental decision every therapist must make. There are many different therapeutic approaches in use today. Therapies at the behavioral and cognitive-behavioral end of the spectrum work in a very focused way to address specific problems, while psychodynamic approaches are more open-ended and exploratory in nature. Some therapists use one approach exclusively, while others draw upon several. For example, if a child were referred to me because he began acting out when his parents separated, I would probably begin with a behavioral approach, and give the parents some guidance on how to contain the acting out. But I would also use psychodynamic work: I would see the child in play therapy to understand the dynamics and emotions underlying his acting out, and I would use the play to help him develop more appropriate and effective ways of expressing his feelings.

Because I had worked for a while before beginning my Ph.D., I was exposed to different kinds of therapies, and that helped me develop a sense of the kind of therapeutic work I wanted to do. Before choosing a graduate program, it really helps to learn about the major therapeutic approaches and to research different graduate programs. Some programs focus on one therapeutic approach—one school might be very psychodynamically oriented, another much more cognitively oriented—while other programs have fairly diverse faculties. The program I attended had a nice mix, so I was exposed to a variety of different models and theoretical approaches. And that worked well for me.

Are some therapeutic orientations more in demand or in vogue now?
With the advent of managed care, the focus has shifted towards short-term therapy. Many HMOs cover only five to ten visits per year with a mental health professional. To prepare their students for that kind of work, graduate programs have had to put more emphasis on short-term therapy. Solution-focused and cognitive-behavioral therapies have become more popular because they are well suited for short-term work. Some graduate programs are still very psychodynamic in nature, but students need to be aware that it may be difficult for them to do long-term, in-depth therapy, or at least to get insurance reimbursement for such work.

Does short-term therapy work well with children?
It depends on the problem. Some children come in for problems that are very circumscribed. In those situations, short-term therapy can be very helpful. However, many children who come into therapy have significant problems and/or are living in chaotic, dysfunctional environments, and their problems are often not amenable to quick fixes.

For example, consider a child who has recently begun wetting the bed after having been dry for years. You could do very symptom-focused work, suggesting behavioral exercises to reduce or stop bed-wetting. However, you may also suspect that there is an underlying emotional reason for the start of the bed-wetting. Whether or not you have the time to explore that possibility may unfortunately be dictated by the client's mental health insurance benefits. If there is an underlying issue that is not addressed, the child is likely to be back later with some other problem. Insurance carriers differ in the extent to which they appreciate that if a child is exhibiting serious problems, it is worthwhile—and cost-effective in the long run—to take the time to determine the whole scope of the problem.

Could you talk more about the challenges of working with children versus adults?
When you work with children, you usually have to work with many other people in the child's life—the parents, the family, the school. If the child has been abused or neglected, you will probably also be working with a social service agency and possibly the courts. The fact that there are so many people and systems to deal with is one reason children are challenging to treat. Also, a great deal of time is spent on paperwork.

However, the most fundamental difference is that children are not masters of their destiny: they are at the mercy of decisions made by other people—from their parents and teachers to the courts—and they do not have the freedom that an adult has to make changes in their environment. This is an inherent challenge in working with children, not an arbitrary one, as insurance coverage is. It can be very frustrating (for me and for the child)—a child can be making good progress in therapy, but if what is problematic in the

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environment doesn't change, it can be hard for the child to make additional progress or even to sustain the progress made. For that reason, it is often helpful to have family therapy sessions in addition to individual sessions with the child.

This touches on another aspect of your training—the psychological preparation. Could you talk about that?

As a psychologist, especially a child psychologist, you work with individuals who have endured terrible things—physical abuse, sexual trauma, abandonment—and your training must prepare you to handle the strong emotions you will feel. Having good supervisors in the clinical phase of my training was at least as important as having good teachers in the academic phase. A good supervisor was someone who was not only a good clinician herself—someone who could help me understand the dynamics of the case, formulate a treatment plan, and help develop my therapeutic skills—but was also someone I could talk to about my feelings about the case, the child, and the child's parents or guardians. One of the most important things to learn as a therapist is to be aware of your feelings, but not to let them interfere with your work. During your training (and after as well), it's very important to have someone with whom you can be open about your feelings and who can help you see how your feelings might be affecting your judgment or your clinical interventions.

Clinical psychology graduate students are also encouraged to undertake their own personal therapy. One of my teachers said, "As a therapist, you are your own tool. In order to use it well, you need to know it." Personal therapy helps you understand your own dynamics, so that if one of your issues gets ignited in a therapeutic session, you can say, "I recognize this. I know why I am feeling this way toward this person." It's the only responsible way to be a therapist: to be as self-aware as you can be. Even now that I am licensed and am no longer required to have supervision, I still meet regularly with a peer consultation group because ongoing feedback from people who can view your cases and your work with detachment is, I think, imperative to doing good work.

You're now a supervisor yourself. Do you enjoy that role, too?

Very much. I supervise students in their clinical practicums, and just as in my work as a therapist, I enjoy seeing people develop new competencies and confidence in their abilities, and come into their own.

Do you have any advice for people considering careers in clinical psychology?

First of all, you need to know that it's a long haul. Graduate school takes at least five years. Then most people do a post-doc because you need to have a year of post-graduate supervision before you can sit for the licensing exam. Then you have to take the licensing exam. For a while, it feels like there's always one more hurdle to get over, and you need to be prepared for that. It's also important to continue your development after licensing by attending conferences, seminars, and so on. You should also know that you're not necessarily going to make a lot of money. If money is something you're after, go into business or law or engineering.

If you are considering clinical psychology, start doing relevant activities in high school or college: volunteer in a hospital or clinic, become a Big Brother or Big Sister, work as a peer counselor. I benefitted from working in the real world before starting my Ph.D. because I had a clearer sense of the direction I wanted to go in and of what my options were. I also had more life experience to draw upon.

Finally, I want to emphasize that this profession is challenging in many ways. You work with people who may be in significant distress and so it can be emotionally draining. It's not the kind of job that you can always leave behind on Friday and not think about until Monday. You may have phone calls and even crises on the weekends. But it's also deeply rewarding. It's more than a job to me—it's a big part of who I am. Most of the time, I feel really lucky to be doing this work.

Selected Resources for Further Reading

Dibs in Search of Self by Virginia Axline (Ballantine Books, 1990).

Keeping Hope Alive: On Becoming a Psychotherapist by F. Robert Redman (Harper Collins, 1986).

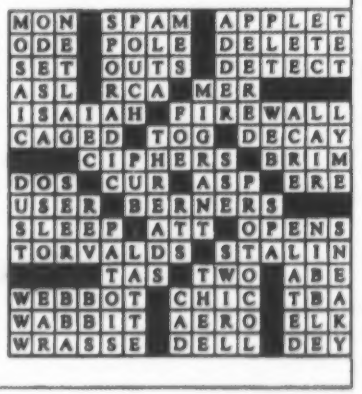
Love's Executioner, and Other Tales of Psychotherapy by Irvin D. Yalom (Harper Collins, 1990).

Play Therapy by Virginia Axline (Ballantine Books, 1982).

The American Psychological Association: *www.apa.org*

More about ... Berners-Lee

It's hard to believe that the billion-pages-and-counting Web is barely ten years old—and that it sprang from the mind of one man. As a software engineer at CERN, the European Laboratory for Particle Physics, Tim Berners-Lee proposed a network of hypertext documents to improve communications within the high-energy physics community. The World Wide Web went online at CERN in 1990 and was released to the public in 1991. Now the director of the World Wide Web Consortium at MIT, Berners-Lee wrote a user-friendly version of this remarkable story in *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web.*



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PLANNING AHEAD FOR COLLEGE

by Linda E. Brody, Ed.D.

The SAT and College Admissions

Recently, the President of the University of California made headlines when he called for eliminating the SAT-I as a requirement for admission to the eight undergraduate campuses in the system, including Berkeley and UCLA. This is not the first college or university to drop the SAT-I as a requirement for admission. Mount Holyoke, Dickinson, and Bowdoin Colleges are among the prestigious schools that have made the SAT-I or ACT optional for admission, though the vast majority of applicants to these schools submit test scores anyway.

There has also been a quiet trend in the other direction. Lafayette College, which had made the SAT-I or ACT optional for five years, is now requiring it again. And the City University of New York, which found too many entrants unprepared for college, began requiring these tests for admission in 1999 after many years of an Open Admission policy.

The SAT in particular and college admissions tests in general remain controversial, primarily because critics question whether bright students from poor backgrounds can develop the skills necessary to do well on these tests. Yet the SAT was developed specifically to help colleges identify students who lack a rigorous preparatory curriculum but can solve complex verbal and mathematical problems that aren't highly dependent on content.

Of course, there are also highly intelligent high school students who don't do well on the SAT-I —perhaps due to stress or time pressures. If you are one of these students, some preparation may help boost your confidence and your scores. Following are some suggestions for maximizing your performance on the SAT and the other standardized tests scores you will submit to colleges.

• **Take practice tests.** You may have taken the SAT-I in 7th or 8th grade as part of a talent search, giving you some insight into what to expect when you take it for college admission. But additional practice may still be helpful, and you can purchase books with old SATs in any bookstore. Take these tests under timed conditions until you are very familiar with the format and the type of questions asked.

• **Consider a prep course.** While studies suggest that SAT prep courses result in minimal point gains for the majority of participants, some individual students find such courses helpful. It is important to note, however, that the more effective prep courses require the greatest time commitment. If such a time commitment will have a negative impact on your grades or extracurricular activities, you might be better served focusing on these instead. Alternatively, check out the SAT preparation tools being offered by the College Board—see www.collegeboard.org

• **Take the SAT-I for college no later than spring of junior year.** This will leave you time to take it again in the fall of senior year if your performance is lower than you expected.

• **Seek tutorial help in areas of weakness.** While the SAT is intended to be an aptitude rather than an achievement test, it does assume proficiency in certain skills. If, for example, you consistently miss a certain type of geometry problem or if your reading comprehension is weak, get help to develop these skills.

• **Consider being evaluated for a learning disability.** Gifted students' high abilities sometimes mask learning problems, leaving the problems unidentified. If you consistently underperform on standardized tests compared to your achievement in school, an assessment might be helpful. If a learning disability is diagnosed, you can request extra time on the SAT which may help your performance.

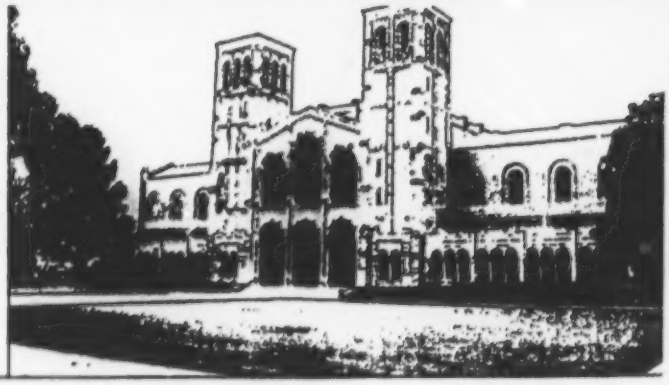
• **Study for the SAT-II.** While it's difficult to study specific content as preparation for the SAT-I, the SAT achievement tests do assess what you have learned in particular subject areas. You can study those subjects and prepare for these tests. Also, while students typically take three subject tests, you can take more if you are likely to do well on them. A strong showing on the SAT subject tests will do much to balance weaker scores on the SAT-I.

• **Take the ACT.** Many colleges will accept either the SAT or ACT, and you may find that your scores are better on the ACT. Of course, you'll need to check the specific requirements of the colleges to which you are applying to see if this is appropriate.

• **Finally, don't stress too much over your SAT scores, whatever they are.** Colleges can tell you about perfect scorers who were denied admission, while lower scorers were accepted on the basis of other qualifications. You can demonstrate your strong abilities and high achievement through your grades, other test scores, extracurricular activities, essay, personal interview, and recommendations, all of which will play important roles in the complex process of college admissions decisions.

STUDENTS REVIEW

UCLA



The Students Review series is intended to aid prospective college students in their search by offering insiders' views of selected colleges and universities, as expressed by current undergraduates or recent graduates who have high academic ability. Note that the number of reviewers is small. Consider their personal perspectives as only one factor as you gather information and impressions from many sources.

Our reviewers include 19 students, who major(ed) in anthropology (1), biochemistry (1), biology (2), business administration (1), classics (1), English (1), environmental studies (1), history (3), marine biology (1), mathematics (1), mathematics of computing (1), music performance (1), neuroscience (1), political science (4), sociology (1), and theatre arts (1). (The number of majors exceeds 19 because several students have double majors.) Students' comments appear within quotation marks.

Quality of Academic Instruction for Undergraduates

UCLA is consistently ranked by U.S. News & World Report among the top three public universities in the country in terms of academic distinction, library resources, and distinguished faculty. The school offers over 100 majors to its over 24,000 undergraduates. Reviewers praised the faculty and the academics, while also noting that students must take considerable initiative and responsibility.

"UCLA is a recognized leader in higher education. The facilities are excellent, and the resources unparalleled. The overall quality of education is comparable to that at any Ivy League school. It is quite a large place. The lower division courses tend to have 200-500 students, with smaller lab or discussion groups, while upper division classes range from small (15) to medium (80-100), depending on the major. It requires a great degree of independence to seek out professors, courses, and guidance. The undergraduate experience varies significantly depending on the department. The film school, for example, is among the best in the country, with significant individual attention. A major like biology, however, may lend itself to taking classes with 300 students most of the time."

"UCLA is a complete university—it has everything that you could possibly want to study, and many of the departments are ranked among the top 20, if not top 10, in the country. So if you're undecided about a major, this is a great place to explore the universe in your first two years. And when you do pick a major, chances are that it will be a renowned department. The professors at UCLA are amazing people. Some of my professors in political science were advisors to presidents. Although the classes can be very large in the first two years, the poli sci professors were very accessible. Once you get to your junior year, it's awesome. I was on a first-name basis with most of my professors."

"It's thrilling to be taught by men and women who are so highly respected in their field. But being in a popular major had its drawbacks; even in upper-level courses, I don't think I ever had a class of less than 60 or 70 people."

"The school operates on the quarter system—ten weeks of instruction, one week of final exams—which accelerates the learning process significantly. There is no grade inflation at UCLA, but it isn't a cutthroat place either. It is very fair. You do the work, you get the grade you deserve. And graduate schools know that—UCLA sends more people to graduate school than any other university in America."

"Being in a small major at UCLA had all the advantages one would expect from a small college: I got lots of individual attention and knew all my professors quite well. On the other hand, because we were within such a large university, I was able to try all sorts of new topics in the process of trying to find what direction to pursue in life."

"The Marine Biology program has a special field studies quarter that allows students to spend a full quarter on location (at the Hawaii Institute of Marine Biology, the Bodega Bay Marine Lab, etc.) where they design and perform independent field research. It was a great experience!"

Social Life

"If ever there was a place where a diverse group of people could each find five different things to do, UCLA is it. The opportunities for doing things outside the classroom are endless. The campus really buzzes with activity, and it is very easy to have too many commitments besides school work! Sporting events, of which there are many, offer an opportunity to be a part of a rousing school spirit. UCLA also offers a unique opportunity to explore one of the culturally richest areas in the world. LA is a wonderful city with a cornucopia of cultural and ethnic experiences: film, theatre, dramatic arts, and cultural festivals throughout the year, as well as opportunities to meet some of the most influential minds of our time. It's a great place to be a twenty-something."

"I highly recommend staying in one of the many dorms on campus your freshman year. It was a fun mix. Future Olympians and NBA all-stars hang out with future engineers, doctors, poets, and lawyers. After that, most people move to apartments around campus, where a lot of the social life happens. There are many first-run theatres, with many movie premieres, all within walking distance of campus. Then there is the rest of Los Angeles. Where do I begin? There's so much to see and do: the Getty

Museum, Beverly Hills, Hollywood, Disneyland, Lakers, Clippers, Dodgers, Angels, Kings, concerts, beaches."

"Social life is terrific! UCLA is in one of the most beautiful urban areas in the country, not far from Beverly Hills. Westwood, UCLA's 'college town,' is very safe and has everything: great restaurants, record and clothing stores, bars, coffee shops, and fabulous movie theaters. Star-sightings are not uncommon, especially during movie premieres."

What Do You Like Best about UCLA?

The wealth of opportunities of all sorts and the strong school spirit were repeatedly cited.

"UCLA was everything I wanted in a university. I went to a relatively small high school and wanted a large campus. I did not want to feel like anyone was looking over my shoulder. I loved the fact that we were on the quarter system and that every 10 weeks you got a new set of classes. (I wish the real world had that much variety!)"

"The countless opportunities for personal and intellectual growth. And the UCLA spirit. The university is full of energy and excitement. It's like going to a Big Ten school, but with better academics. Although we are a big school, people are definitely united in spirit, and that really shows up in the pride we have in our sports teams. There's nothing like 90,000 people cheering on the Bruins!"

"We are a truly diverse community at UCLA, in a truly diverse city. The future of America will look something like UCLA—an equal mix of all colors and beliefs."

"UCLA's student make-up means you are constantly in touch with people who are like you, as well as growing, sharing, and learning with students who are very different from you. This diversity makes every moment richer. In one of my anthropology classes, we were studying kinship and family. We began to talk about cultures where people believe that they can trace their family tree back to a spiritual deity. The teacher asked if anyone was familiar with this kinship system, and one student raised his hand, sharing that this was the family tree of his father's family. The discussion went from something abstract to something very real for us all because of the diversity of our classroom."

What Do You Like Least about UCLA?

"Bureaucracy—lots of it. Sometimes you feel like you're just a number, and getting academic advising is a challenge. But sooner or later, you have to grow up and do things for yourself. I think of it as a sort of tough love. UCLA made me more determined and aggressive in pursuing my goals."

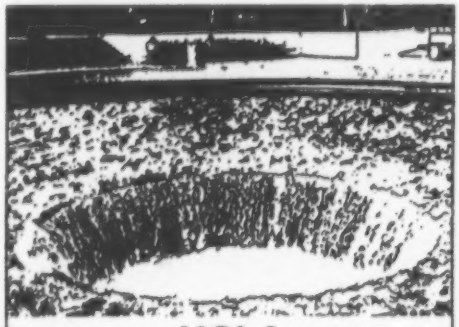
"You really have to take the initiative; no one will spoon-feed you information or guidance. I wish I'd been more aware of things like internship opportunities, but it's up to you to find these things on your own. I also had skills but no idea what I wanted to do when I graduated, so a bit more nurturing might have been welcome. Parking was also an absolute nightmare."

Who Would Be Most Compatible with the Academic and Social Atmosphere at UCLA?

"A self-starter. Someone who is independent and won't feel lost in a crowd. It also helps to know what you want to major in, because there are too many choices and not enough time."

"Someone who intends to get the most out of his or her college experience and who is ready for the opportunity and challenge that a large university provides. It's perfect for introverts who wish to become more outgoing; it's incredibly liberating to have the option of anonymity."

"I happen to think that anyone will fit in here. Anyone can find a comfort zone here. With 24,000 undergrads, I'm pretty sure there's somebody out there a lot like you. If you want to get involved and stay busy, you can do that. If you want to be mellow and have a low profile, that's cool, too."



UCLA

Los Angeles, CA 90095
(510) 825-5101

4-year coed public university

Campus just west of Hollywood

Full-time undergraduate enrollment 1999-2000: ~11,100 men; ~15,600 women.

Special features: One of the top-ranked research libraries in the U.S., Fowler Museum of Cultural History, Hammer Art Museum, Geffen Playhouse, Film & Television Archive, Center for Digital Arts, Japanese Garden, Botanical Garden, Sculpture Garden, the Rose Bowl.

If You Had It to Do over Again, Would You Go to UCLA?

All reviewers said yes.

"Yes. My years at UCLA were some of the greatest of my life. They made me who I am today. UCLA opened doors for me that I would have never known were there. It gave me the chance to shine in my own spotlight while also immersing me in a vibrant community of people who encouraged and shaped me."

"Absolutely. When I was in high school, everyone knew me, and I was constantly expected to be very good at everything I did. At UCLA, I could be more anonymous, try new things, and not feel the pressure to keep up appearances as I searched for my direction."

"Absolutely! I grew as a person in multiple dimensions at UCLA. I made lifelong friends there, and that includes my professors. I am proud to be a Bruin."

As you try to find the college or university best suited to you, the views presented above may be helpful. Keep in mind that these students might have had similar positive or negative experiences had they attended a different school. At any college, it is important to seek out challenging academic experiences and to create a social life that fits your personal style.

Note: The students quoted in the Students Review series are expressing their own views, which are not necessarily those of JHU or CTY.

The Mandelbrot Competition

*The **Mandelbrot Competition** challenges high school students in two divisions: Division A, for advanced problem solvers, and Division B, for those less experienced. In both divisions, students participate in four rounds throughout the school year; each round includes both an individual and a team test (40 minutes each). Tests cover non-calculus topics such as geometry, trigonometry, polynomials, probability, complex numbers, number theory, and classical inequalities. For more information about the **Mandelbrot Competition**, visit www.mandelbrot.org or call (671) 661-3188.*

by David Hankin

The students on the math team at my school love the Mandelbrot Competition, in part because each contest seems to contain a new idea or a new twist on an old idea. Problems are worth one, two, or three points based on the difficulty level. Problems at every level require creative reasoning and often lead to unexpected insights.

Consider this three-point problem from last year's contest:

Let $p(x)$ be the degree thirteen polynomial such that $p(\cos\alpha) = \cos(13\alpha)$ for any angle α. Find the sum of the coefficients of $p(x)$.

You might think of using double-angle formulas and cosine-of-a-sum formulas to express $\cos(13\alpha)$ in terms of $\cos\alpha$, but seasons could change while you are doing all that algebra. The high-powered approach might cross your mind next: use DeMoivre's Theorem. You would write $\cos 13\alpha + i \sin 13\alpha = (\cos\alpha + i \sin\alpha)^{13}$, apply the binomial expansion to the right-hand side, and set the real parts equal. But this would also take too much time. But wait! The phrase "sum of the coefficients" reminds us of the famous fact that the sum of the coefficients of a polynomial $p(x)$ is equal to $p(1)$. So, in this case, we need only find α for which $\cos\alpha = 1$, namely $\alpha = 90^\circ$ (give or take multiples of 360°). Thus the sum of the coefficients is equal to $p(1) = p(\cos 90^\circ) = \cos(13\cdot 90^\circ) = \cos(90 + 12\cdot 90)^\circ = \cos 90^\circ = 1$.

Sometimes, as in problems like that, insights come in the problem-solving process. Other times, as in the following example, a problem can lead us to think beyond the solution.

On his calculator Stefan notices that $19^2 = 361$, $199^2 = 39601$, and $1999^2 = 3996001$. What will be the sum of the digits of $1{,}999{,}999{,}999^2$?

The keen pattern-observers among us will note that each new 9 on the left of these equations seems to add a new 9 and a new 0 on the right side. They will correctly conclude that nine 9s on the left will yield eight 9s and eight 0s on the right, and that the requested digit-sum is thus $8\cdot 9+3+6+1=82$.

Getting the correct answer is our primary goal during the contest itself. To get the most from a contest, though, we should fully explore the problems afterwards. Why does the pattern we noticed work? If you have ever done mental computation, such as $51^2 = (50+1)^2 = 50^2 + 2\cdot 50 + 1 = 2500 + 100 + 1 = 2601$, then you can deduce what comes next. Note that $1{,}999{,}999{,}999 = (2{,}000{,}000{,}000 - 1)^2 = (2\cdot 10^9 - 1)^2 = 4\cdot 10^{18} - 4\cdot 10^9 + 1$

This is the same as the difference of two numbers, the first written with a 4 followed by 17 0s and a 1, and the second written with a 4 followed by nine 0s. Thus the difference will be written with a 3 followed by eight 9s, a 6, eight 0s and a 1. If you are an intrepid explorer of problems, you might want to generalize the pattern and prove your generalization, or create similar problems. What happens if you change the 19 to 29, or if you cube instead of square?

If you want to broaden your understanding of mathematics and experience the challenge of problems that reach beyond the typical, try the Mandelbrot.

***David Hankin** teaches mathematics at Hunter College High School in New York, where he serves as department chair and advisor to the junior and senior math teams. He also currently serves as chair of the AIME committee.*

This is one of the more challenging problems I've seen on the Mandelbrot. As you would probably guess, this problem was worth three points.

In a certain lottery, seven balls are drawn at random from n balls numbered 1 to n. If the probability that no pair of consecutive numbers is drawn is the same as the probability of drawing exactly one pair of consecutive numbers, then determine n.

Visit the *Imagine* Web site at *www.jhu.edu/gifted/imagine/* for the solution to this problem. And check out the Mandelbrot Web site at *www.mandelbrot.org* for more sample problems at all levels.

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Creative Minds Inventing

A Living Education

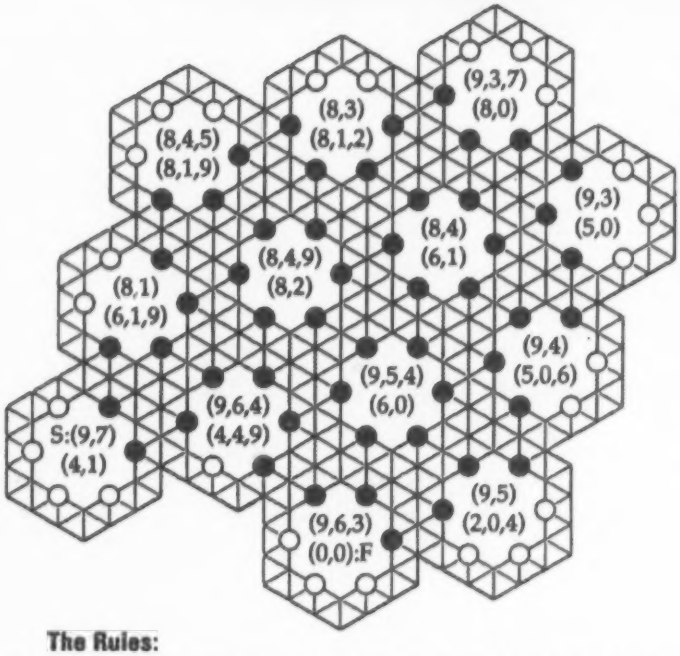
by Lea Stoschek

It's late December and my family and I have finally returned home from three months living in the city. A small house built by my parents 25 years ago and the hundred acres surrounding it on the easterly facing hill in upstate New York. This is my home. As we trudge up the steep and winding path towards the pond with our skates in hand I glance up at the bright full moon. I begin to recall memories of my 17 years growing up on this land. I skate around the pond like I have done every winter I have lived on this hill, in these woods and fields, my entire life. The moon illuminates the trees, the ravines, the surrounding hills and valleys, the land that has taught me much of what I know and has shaped me into the person I am today. Under full moons my family and I have followed the tracks of deer, explored forgotten trails, and cross country skied for miles. We have swum in cool waters on warm August evenings at moonrise just as the fog settled over the pond. Over the years I have developed a deep rooted connection to this land; from my bones to the veins running through my body, to the ravines and small creeks mapping the surface of this hill. After living in the city for three months I am struck by the silence. It has always been quiet here. The only sounds I hear now are the blades of our skates scraping the frozen pond.

But this pond is not always frozen. In spring it teems with life. Often on early spring nights my mom would hand me a flashlight and head outside into the warm darkness. The peepers were calling and she was out to look for them. I would run after my mom, catch up with her on the dew drenched path, through the trough which is leading up the bank to the pond. Crouching on all fours we would stalk the tiny, and elusive frogs for hours. By sound that was calling out from just [illegible] flashlights only to see a [illegible] got lucky, we'd catch sight [illegible] the frog itself. Holding [illegible] controlled, with the [illegible] My world [illegible]

Knossos Games

by Tim Boester



A Primer on Unusually Ordered Sets

The number systems we normally deal with are well ordered; that is, we may compare any two numbers in the set to one another. However, sets can be ordered in other ways. In a *partially ordered set*, we can compare a given number only to *some* of the other numbers in the set, according to the rules of that set. For example, in a partially ordered set in which only numbers with the same number of digits may be compared, we could say that 2 is less than 3 and that 12 is less than 22, but not that 7 is less than 12. Those last two numbers simply cannot be compared because they do not have the same number of digits.

This puzzle is based on a more complicated ordering of a set, in which numbers may be compared with numbers that have not only the same number of digits (n) but also n+1 or n-1 digits.

The Goal:

Move from hexagon to hexagon, starting with the "number" marked S and ending with the "number" marked F.

The Rules:

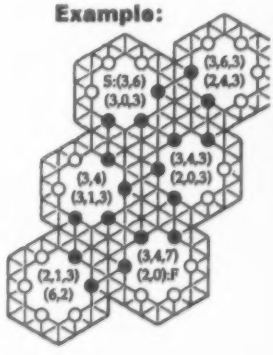
1. You may move between "numbers" with the same number of digits if one and only one digit is lower in the second "number." Example: You may move from (3,7) to (3,6) or (2,7) but not from (3,7) to (2,6) or (3,8). You may move from (3,7,2) to (3,6,2) but not to (3,6,1).

2. You may move from a 2- to a 3-digit "number"only if the first two digits are the same in the two "numbers." Example: You may move from (3,2) to (3,2,7) but not to (3,7,2).

3. You may move from a 3- to a 2-digit "number" if one of the first two digits is the same in the two "numbers" and the other of the first two digits is lower in the second "number." Example: You may move from (4,6,2) to (4,5) or (3,6) but not to (4,6), (4,7), or (5,6).

4. The first time you land on a hexagon, use the top "number" in the hexagon. If you revisit the hexagon, use the bottom "number." Confused? Here's the solution path to the small example, to help you get the feel of moving according to these rules:
S:(3,6) - (3,4) - (3,4,7) - (3,4,3) - (3,1,3) - (2,1,3) - (2,0):F

Example:



*A graduate student in educational psychology at the University of Wisconsin, **Tim Boester** now has additional puzzles on his home page: http://homepage.mac.com/boester*

Solution to Knossos Games in our March/April issue:

Start - A - C - B - C - D - A - Finish
(moving clockwise around the puzzle)

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